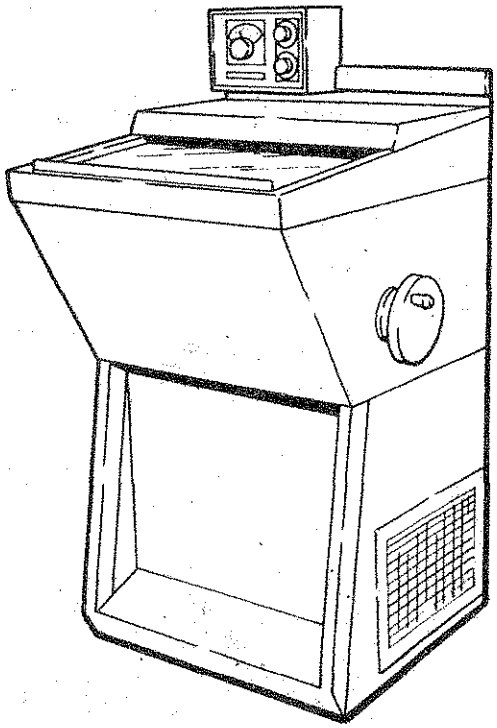
Service Manual

BTU's
2345 max

TISSUE-TEK® II Microtome/Cryostat



CRYOSTAT MODELS:

4553	115 VAC/60 Hz
4554	220 VAC/50 Hz
4558	220 VAC/60 Hz
4559	100 VAC/50 Hz

MICROTOME MODEL 4551

TISSUE-TEK® II

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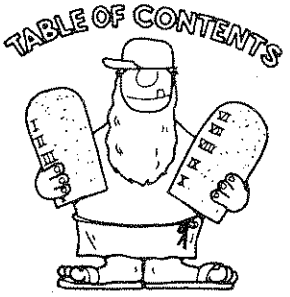
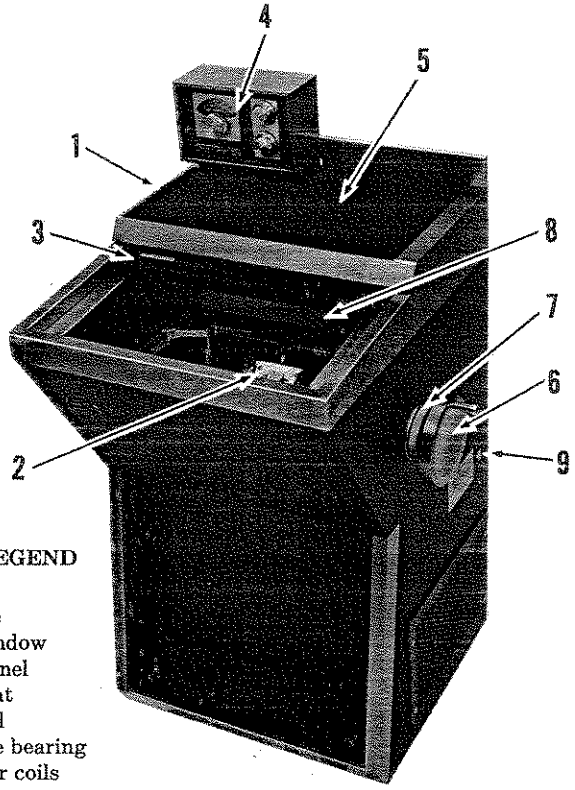




LEGEND

1. Cryostat
2. Microtome
3. Sliding window
4. Control panel
5. Rubber mat
6. Handwheel
7. Adjustable bearing
8. Evaporator coils
9. Ground fault circuit interrupt

Figure 1-1
TISSUE-TEK II
MICROTOME/CRYOSTAT

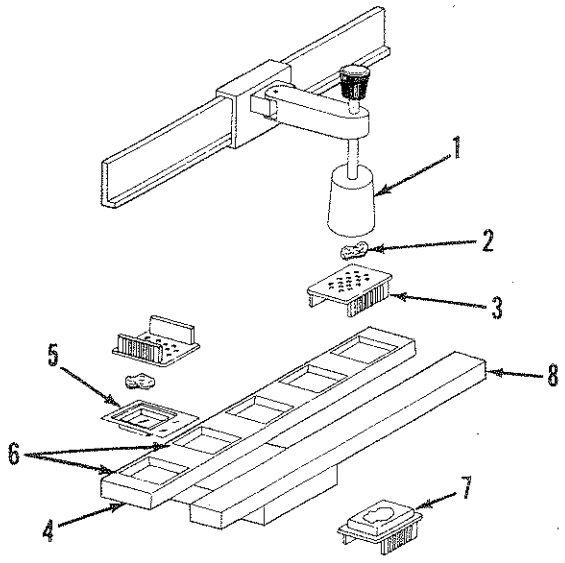


Figure 1-3
CRYOSTAT TISSUE EMBEDDING AND FREEZING SYSTEM

LEGEND

1. Heat extractor
2. Tissue
3. Object holder
4. Cryobar®
5. Cryomold®
6. Freeze well
7. Tissue blocked and ready for sectioning
8. Freeze plate

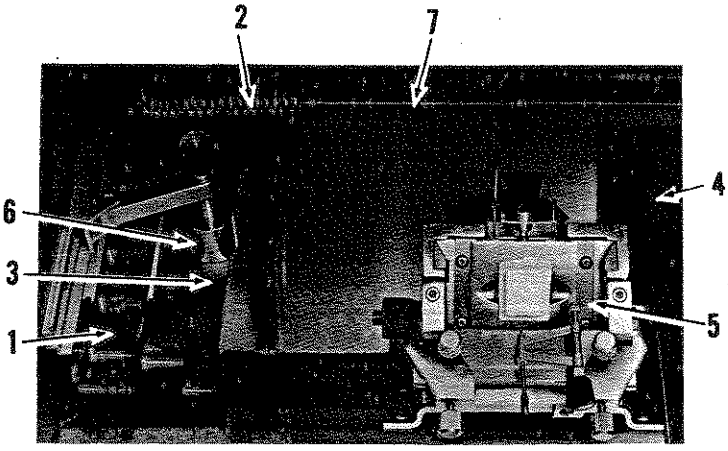


Figure 1-2
CRYOSTAT CHAMBER

LEGEND

1. Cryobar
2. Thermocouple bulb for thermostat
3. Freeze plate
4. Utility tray
5. Microtome
6. Heat extractor
7. Drain pan

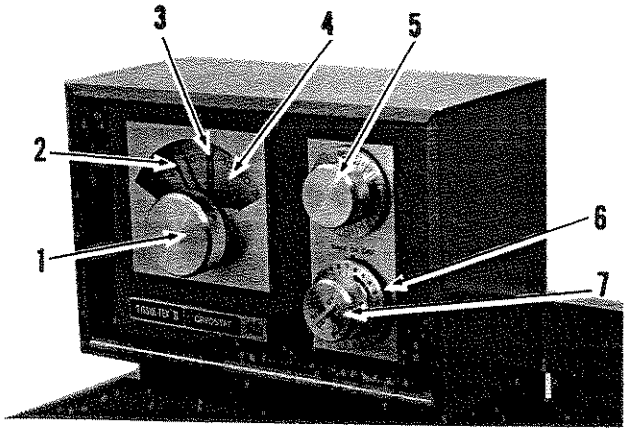


Figure 1-4
CRYOSTAT CONTROL PANEL

LEGEND

1. Thermostat temperature control knob
2. Black pointer — Sets chamber temperature
3. Blue pointer — Reads chamber temperature
4. Temperature scale
5. OFF-ON switch
6. TIME OF DAY dial
7. TIME OF DEFROST dial

SECTION 1 INTRODUCTION

1-1 USING THE MANUAL

1-1-1 This Service Manual provides servicing instructions on the TISSUE-TEK® II Microtome/Cryostat. This instrument is manufactured for the Lab-Tek Division by the Ames Division, Miles Laboratories, Inc. All service inquiries on this instrument should be directed to:

Ames/Lab-Tek
Instrument Service Repair Deparment
P.O. Box 2004
Mishawaka, IN 46544
Telephone AC 219 264-8901

In ex-U.S. areas assistance is available from local sales representative or area Miles Laboratories, Inc., office.

1-1-2 The Sections of this Manual are coordinated together for quick reference. All pages, paragraphs and figures are numbered by section. Pages are punched for standard three-ring binder which allows for storage and changes or additions in Manual content.

1-2 GENERAL DESCRIPTION

1-2-1 The Tissue-Tek II Microtome/Cryostat is a self-contained combination unit consisting of an automatic defrost refrigeration chamber (Cryostat) and tissue sectioning machine (Microtome). The system contains the devices necessary for freezing, positioning, securing the frozen specimen, adjusting section thickness, cutting section and keeping section flat. The Cryostat work areas include a utility tray, debris tray, and good Microtome access. The Cryostat top provides easy control access and work area with rubber mat. A heated sliding window provides unobstructed chamber viewing and prevents condensation.

1-2-2 Frozen section technology is described as an art and requires practice to perfect. An operator will need experience before good quality sections can be achieved consistently. No operating instructions can provide experience. This includes the use of the anti-roll devices and section transfer to slide.

1-3 CRYOSTAT DESCRIPTION

1-3-1 Cryostat Chamber (Refer to Figure 1-2)

1-3-1-1 The Cryostat is used for freezing tissues and maintaining a cold environment during tissue cutting operations. The Cryostat is designed for ease of use. The recessed front allows operator to sit while sectioning. The chamber contains a mounting plate for Microtome snap-in mounting. The Microtome couples to the Cryostat handwheel through a shaft and split flex coupling. The handwheel shaft is aligned to the Microtome through an adjustable bearing.

1-3-1-2 Specimen freezing (in O.C.T. compound) is done on a Cryobar® which contains five wells and a freeze plate — see Figure 1-3. The Cryobar is coupled to a cold bar which provides cooling from the refrigeration system — see Paragraph 1-5-1-2. The Cryobar provides two procedures for mounting and freezing tissue. The frozen block embedding procedure uses an inverted tissue freezing process which eliminates poor sections associated with high electrolyte concentrations at the area of slicing. This procedure offers two advantages; Uniform and reproducible blocks of frozen tissue and the ability to cut "tissue ribbons." The second procedure is a conventional procedure which is essentially unchanged from that previously employed in the earlier model Microtome/Cryostat instruments. Refer to Pargraph 2-1 for these procedures.

1-3-1-3 The Cryostat is designed to defrost at 24-hour intervals. The instrument can be turned "off" for cleaning at any time without interrupting the defrost cycle. The chamber is designed such that frost collects first on the evaporator coils. Defrosting the coils regularly maintains a frost-free chamber — see Paragraph 1-5-2.

1-3-1-4 The sliding window is composed of two layers of plate glass with a hermetically sealed air space between. The inside surface of the top glass is coated with a metal oxide that readily and efficiently conducts electricity and heats the entire glass. The lower glass plate functions to insulate the chamber from heat produced on the window. This configuration also improves the cooling efficiency of the chamber.

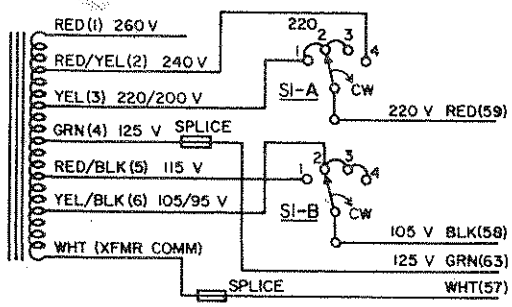
1-3-2 Control Panel (Refer to Figure 1-4)

1-3-2-1 OFF-ON Switch: The OFF-ON switch controls AC line voltage to all Cryostat components except the defrost control timer — see Paragraph 1-4-1.

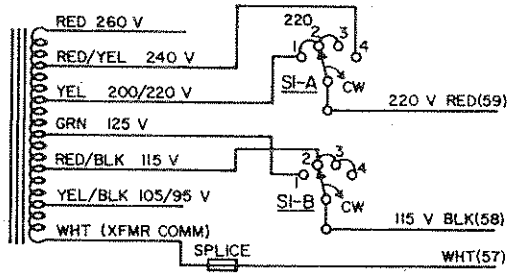
1-3-2-2 Defrost Control Timer: The defrost control timer automatically initiates the Cryostat defrost cycle every 24 hours — see Paragraph 1-4-2. Usually defrost cycles are desired at a time when the Cryostat is not being used. The TIME OF DAY dial and TIME OF DEFROST dial turn independently of each other.

NOTE: TIME OF DEFROST dial turns clockwise only.

However, the TIME OF DAY dial will move when the TIME OF DEFROST dial is turned. The TIME OF DAY dial should be held when setting defrost time.



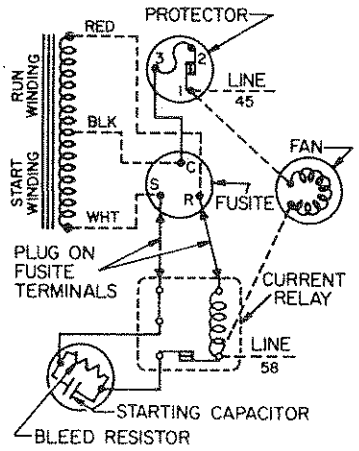
AUTOTRANSFORMER
MODEL 4554 (50 Hz)



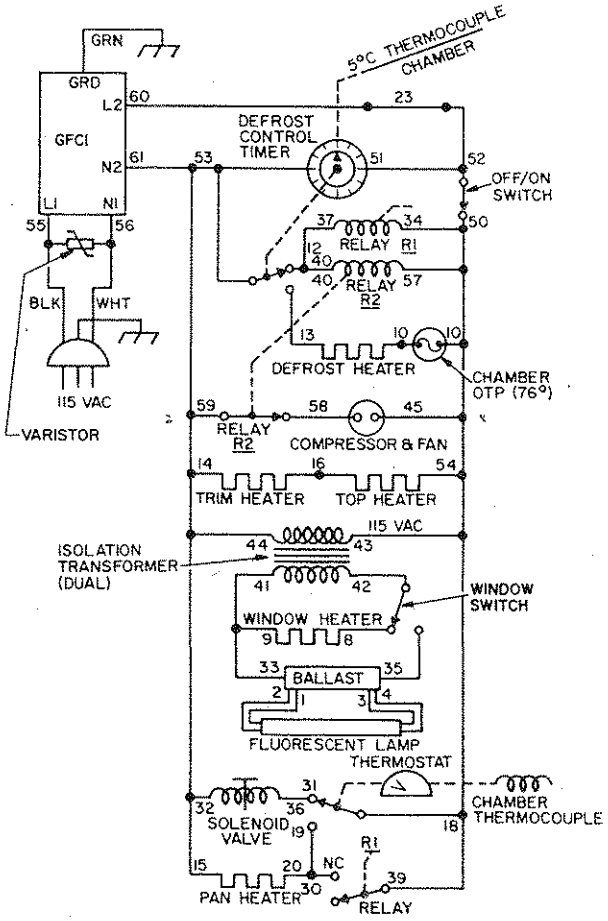
AUTOTRANSFORMER
MODEL 4558 (60 Hz)

NOTES:

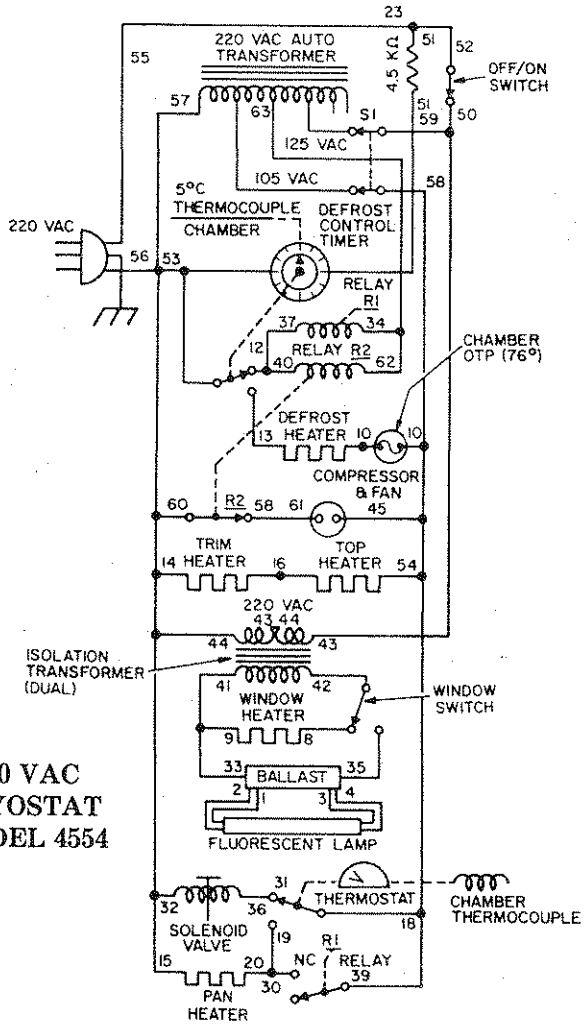
1. Relays R1 & R2 shown energized.
2. Window switch shown in window closed position.
3. Thermostat shown set below chamber temperature condition.
4. 220V 60Hz Model 4558: Autotransformer drives all circuits from 115 VAC tap - See Paragraph 1-4-1-1.
5. Numbers on schematics correspond to wire leads.



COMPRESSOR
SCHEMATIC



CRYOSTAT MODELS
4553 115 VAC
4559 100 VAC



220 VAC
CRYOSTAT
MODEL 4554

Figure 1-5
CRYOSTAT SCHEMATIC DIAGRAMS

1-3-2-3 Thermostat Temperature Control: The thermostat temperature control monitors and controls chamber temperature — see Paragraph 1-4-3. The temperature control dial black pointer is set to the desired chamber temperature by the control knob. The blue pointer indicates chamber temperature at knife blade level.

1-4 CRYOSTAT ELECTRICAL SYSTEM

1-4-1 AC Input Circuits

1-4-1-1 The electrical system schematics are shown in Figure 1-5. Both 115 VAC and 220 AC versions are shown. Model 4553 and 4559 Cryostats have a ground fault circuit interrupt installed. The GFCI provides protection against the hazards of ground-fault currents. Such currents are generally the result of wet wiring or some other electrical defect. Even with the GFCI, electrical shock of less than a normally dangerous duration may be felt.

!WARNING!

If the GFCI device RESET button does not stay in during normal operation or if the self test does not operate as stated (Paragraph 2-2), it is most likely a hazard exists. Troubleshoot system to determine reason.

On 220 VAC instruments, an autotransformer is used to step down voltages. These transformers have switch selectable inputs of 210, 220, 230 & 240 VAC with 220 VAC selected — see Figure 1-5. On the Model 4554 (50 Hz) instrument, the relays are driven from 125 VAC tap. The 105 VAC tap drives the remaining circuits. The Compressor is driven by 105 VAC from the autotransformer on these models.

1-4-2 Defrost Control Timer

(Timer operation Paragraph 1-3-2-2)

1-4-2-1 The defrost control timer operation is independent of the ON-OFF switch. All other circuits are switched by the ON-OFF switch. On 220 VAC instruments, a dropping resistor is used for 115 VAC timers. Timers are either 50 or 60 Hz. The control timer consists of a synchronous clock motor (50 or 60 Hz) driving a special thermocoupled controlled switch through a gear arrangement. The timer will only initiate a defrost cycle when the thermocouple detects a cooled chamber evaporator at time of defrost. The defrost cycle terminates when evaporator temperature reaches 5°C transferring the switch.

1-4-2-2 The defrost control timer controls relays R1/R2 and the chamber defrost heater. When the Cryostat is operating, R1/R2 relays will be energized. When energized R1 opens the pan heater circuit — see Paragraph 1-4-3-1. When de-energized during the defrost cycle, R1 turns the pan heater on. Relay R2 supplies power to the compressor when energized. When a defrost cycle occurs, the relays are de-energized and the chamber defrost heater (475 watts) is turned on. (The compressor is turned off and pan heater turned on.) The defrost heater is designed as part of the evaporator coil assembly.

NOTE: The defrost control timer thermocouple is located across the rear of the evaporator assembly. The thermocouple must be in good contact with the evaporator assembly.

The heater will remain on until the defrost control timer senses the 5°C level. The defrost heater is then turned off and the relays energized.

1-4-2-3 The defrost heater is in series with the chamber Over Temperature Protector (OTP). The OTP is a thermo cut-off (76°C ± 3°C) device which protects the Cryostat if the defrost control timer fails and remains in the defrost cycle.

1-4-3 Temperature Control Thermostat

1-4-3-1 The thermostat controls the pan heater and solenoid valve — see Paragraph 1-5-2-1. The thermostat consists of a thermocoupled controlled switch and dial/pointer mechanism. The thermocouple can be temperature calibrated — see Paragraph 2-5-2. Temperature in the chamber is sensed by the thermostat thermocouple — see Paragraph 1-5-1-1. The temperature range is −30° to +30°C. When chamber temperature is above the selected temperature, the thermostat energizes the solenoid valve. The chamber then cools as described in Paragraph 1-5-2-1.When the thermostat is satisfied, the solenoid valve is de-energized and the pan heater is turned on. The pan heater is used to buck chamber refrigeration and help remove frost build-up. If a warmer chamber temperature is desired, the temperature control dial pointer can be set to desired temperature. The pan heater will then stay on rapidly raising chamber temperature. This eliminates long periods of waiting. During the defrost cycle,the pan heater is turned on by relay R1 — see Paragraph 1-4-2-2.

1-4-4 Circuit Heaters

1-4-4-1 The Cryostat contains five heaters. The defrost heater is described in Paragraph 1-4-2-2. The pan heater heats the evaporator drip pan for moisture removal. This heater is used in a dual function — see Paragraph 1-4-3-1. The trim heater and top heater operate in series and are on when the Cryostat is on. The trim heater (5-2-37) is located around the Cryostat top trim. The top heater (5-2-43) is located in the chamber upper rear. These heaters radiate constant heat in their respective areas.

1-4-4-2 Power is supplied through an isolation transformer to the window heater and fluorescent lamp circuits. The position of the door switch determines if the window heater or lamp is on. With the sliding window closed, the window heater is on. If the window is open, the lamp is on illuminating the chamber.

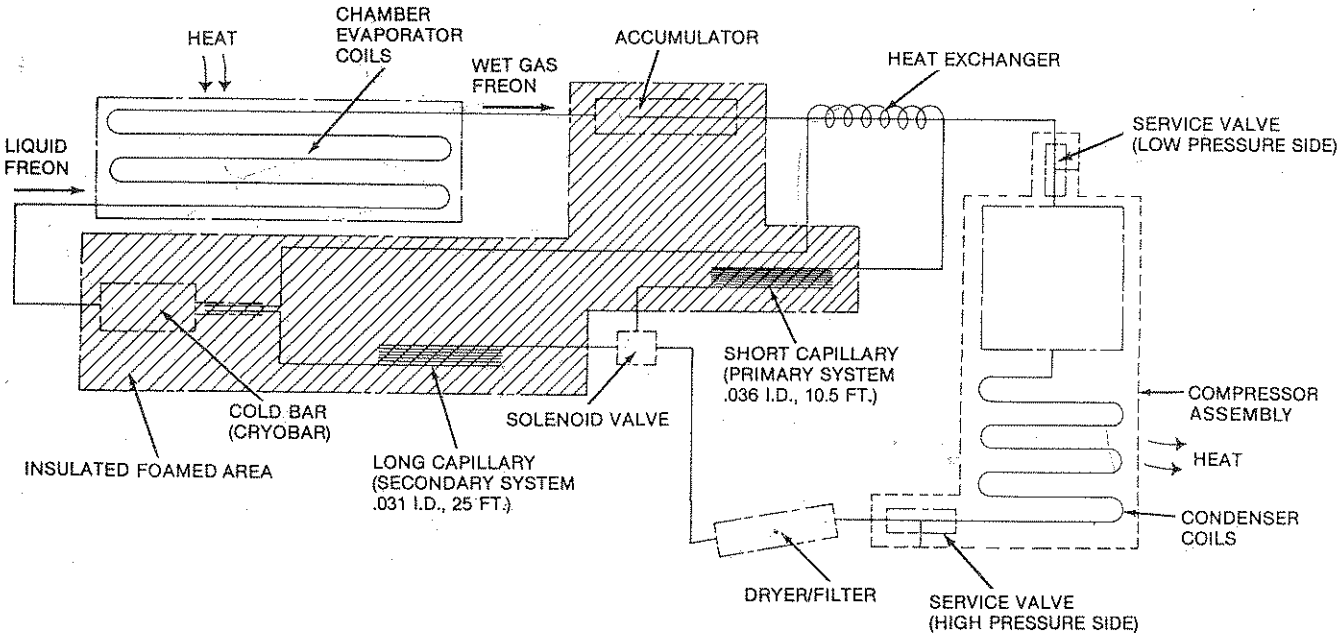


Figure 1-6
CRYOSTAT REFRIGERATION SYSTEM FLOW DIAGRAM

LEGEND

1. Chuck with object holder
2. Gross adjustment wheel
3. Chuck knob
4. Bail type anti-roll device
5. Plate type anti-roll device
6. Locking screws knife blade holder
7. Knife blade holding screws
8. Knife blade
9. Knife blade elevating screws
10. Knife blade holder
11. Chuck locking lever
12. Increment disengaging knob
13. Increment adjusting knob

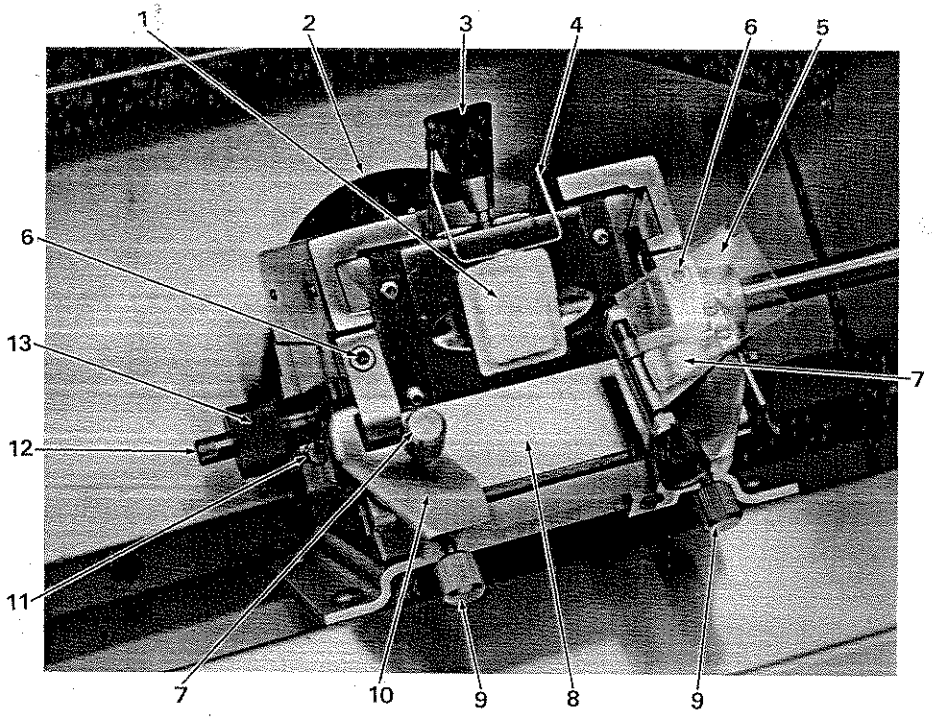


Figure 1-7
MICROTOME COMPONENTS

1-5 CRYOSTAT REFRIGERATION SYSTEM

1-5-1 General System Design

1-5-1-1 The Cryostat refrigeration system is designed to maintain the Cryostat chamber and Microtome in a frost-free condition. Chamber temperature is controlled by an adjustable thermostat from −30°C to room temperature. The desired temperature is set on the adjustable (black) thermostat control dial pointer — see Figure 1-4. The blue pointer on the dial indicates chamber temperature at knife blade level. Chamber temperature is sensed through the coiled thermocouple — see Figure 1-2. Once the chamber reaches the selected temperature, it will maintain that temperature except during the defrost cycle — see Paragraph 1-3-2-2.

1-5-1-2 The Cryostat refrigeration system also maintains the cold bar (with Cryobar®) at a temperature between −37°C and −43°C. The cold bar is driven continuously by the compressor through a "secondary" cooling circuit — see Paragraph 1-5-2-1. The Cryobar is temperature coupled to the cold bar through thermocompound. The Cryobar contains five wells for use with the Cryomolds and adapters, as well as a conventional freeze plate.

NOTE: If the Cryostat is not used on a daily basis, frost may collect on freezing areas of the CRYOBAR — see Paragraph 2-4-4.

A heat extractor slides the entire length of Cryobar for use in specimen processing.

1-5-2 Refrigeration System Operation

1-5-2-1 The refrigeration system flow diagram is shown in Figure 1-6. The system has "primary" and "secondary" circuits both supplied by a continuous running compressor — see Paragraph 1-4-2-2. The "secondary" circuit cools the Cryobar continuously through 25 feet of (0.013 ID) capillary tubing. The "primary" circuit provides chamber cooling through 10-1/2 feet of (0.036 ID) capillary tubing. Both capillary tubes are arranged in 5 inch coils and located in the insulated foam area. Both circuits flow through the cold bar to the chamber evaporating coils when operating. Freon flow in the "primary" circuit is controlled by the solenoid valve which is controlled by the thermostat — see Paragraph 1-4-3-1. The valve allows freon flow to both circuits when the solenoid is energized and to the "secondary" circuit only when the solenoid is de-energized. The chamber evaporator coils provide cooling only when both circuits feed freon through the cold bar.

1-5-2-2 The "primary" circuit freon picks up additional cooling by passing through a heat exchanger tubing system. This is achieved by winding the "primary" circuit tubing around the larger return tubing from the accumulator. This return tubing will normally accumulate frost starting at the bottom of the foam area — see Figure 2-5. The amount of frost on the return tubing will vary between Cryostats and actually depends upon compressor efficiency. Abnormal operation can cause large frost buildup if system is overcharged.

NOTE: The heat exchanger tubing on newer instruments may be covered by rubber insulation tubing. If this is the case, it will be difficult to tell where the frost line is.

1-5-2-3 The compressor has two service valves with external access fittings. These valves are accessible from the Cryostat rear for servicing. General refrigeration system check/charge procedures are provided in Paragraph 2-6. The high pressure output side of the compressor is fed through the dryer/filter which removes moisture from the system.

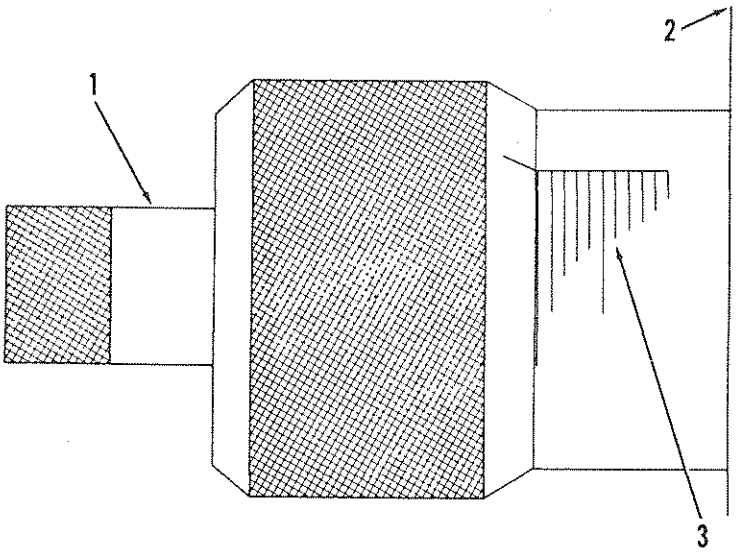
1-6 MICROTOME DESCRIPTION

(Refer to Figure 1-7)

1-6-1 Microtome Model 4551 is designed to cut thin frozen tissue sections for staining and microscopic study. Section thickness is adjustable from 2 to 20 micrometers (microns) — in 2 micrometer increments. Specimens, frozen in O.C.T. compounds on object holders, are secured in the Microtome chuck. The chuck knob drives the chuck jaw which secures the object holder. The chuck is driven on vertical gibs against the knife blade for specimen cutting. The chuck is driven by a roller and crank arm from a crank shaft and gear arrangement. These moving items must all be clean, moisture free and properly lubricated — see Paragraph 2-8-4.

1-6-2 The knife blade is adjusted and secured in a holder which moves with the Microtome top slider assembly — see Paragraph 2-8-1. It is the precision movements of the top slider assembly which establish section thickness. The top slider is driven on horizontal gibs through a lead screw/pawl arm assembly — see Figure 2-8. An actuator pin on the crank shaft operates the pawl arm assembly which drives a ratchet wheel pinned to the lead screw. An increment adjusting knob controls the amount of movement of the pawl arm assembly. The increment adjusting knob is calibrated in microns — see Figure 1-8. Each red division is equivalent to two microns of feed for each revolution of the handwheel. There are 11 marks on the mechanism providing a range of section thickness from 2 to 20 microns. The first mark represents 0 (no movement). This mark is closest to the Microtome body. Top slider (and knife blade) movement occurs when the chuck rises and passes through the top point of its movement.

NOTE: The handwheel must always be continuously turned clockwise and never stopped and reversed. Should the handwheel be stopped and reversed at the point of chuck travel, the increment movement will repeat and the section width will be doubled.



LEGEND
1. Increment disengaging knob
2. Microtome body
3. Increment gauge (2 microns each)

Figure 1-8
INCREMENT ADJUSTING MECHANISM (SET AT 20 MICRONS)

Figure 1-9
ACCESSORIES

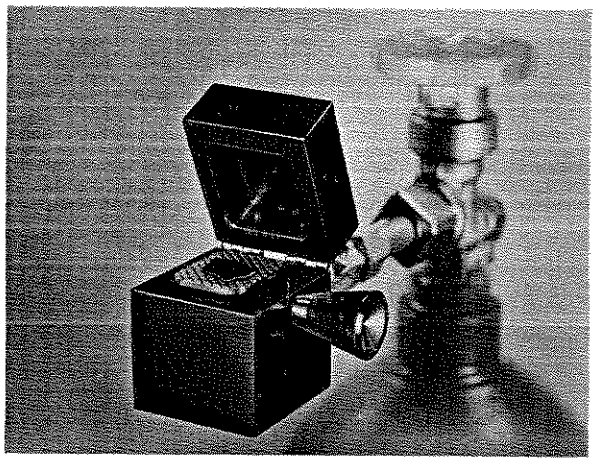


Figure 1-10
TISSUE-TEK II CO_2 QUICK-FREEZE ATTACHMENT

The increment disengaging knob places the pawl arm assembly in a disengaged position when depressed. This allows the chuck to be driven with no knife advancement.

1-6-3 The gross adjusting feed wheel is used to drive the lead screw and top slider for gross movement of the knife blade (or top slider). The chuck locking lever locks the chuck at the top of its travel.

1-6-4 The Microtome has two cut tissue anti-roll devices which aid in cutting and slide mounting sections. Use of these anti-roll devices is described in Paragraphs 2-1-4 and 2-1-5.

1-7 ACCESSORIES

1-7-1 Tissue-Tek® II Object Holder

1-7-1-1 The metal object holder is designed to provide a better grip and retention of the frozen tissue to be sectioned. It facilitates cutting frozen section by assuring proper and firm holding of the tissue. Both packaged 6 per box, reusable.

4560 Object Holder (without holes) for use with CO_2 Quick-Freeze Attachment or Cryobar.
4561 Object Holder (with holes) for use on Cryobar.

1-7-2 Tissue-Tek® II Cryomolds

1-7-2-1 Cryomolds are vinyl plastic, disposable molds which facilitate the embedding process. Use is described under "Frozen Block Procedure," Paragraph 2-1-2-1. Cryomold may be selected from 3 sizes to correspond with size of specimen. Packaged 100 per dispenser box.

4557 Standard 25 x 20 x 5
4565 Biopsy 10 x 10 x 5
4566 Intermediate 15 x 15 x 5

1-7-3 Tissue-Tek® II Adapters

1-7-3-1 Adapters support smaller size Cryomolds in freeze wells and facilitate rapid freezing process. Packaged 12 per box.

4567 Biopsy 10 x 10 x 5
4566 Intermediate 15 x 15 x 5

1-7-4 Tissue-Tek® II O.C.T. Compound

1-7-4-1 O.C.T. Compound 4583 is a formulation of water soluble glycols and resins. Using either the frozen block embedding procedure or the conventional embedding procedure, completely embed the specimen in the medium. Then freeze the specimen to the desired temperature. After the section is cut and placed on a slide, O.C.T. Compound, being water soluble, can be washed off the slide with water.

1-7-5 Tissue Tek® II CO_2 Quick-Freeze Attachment

1-7-5-1 The CO_2 Quick-Freeze Attachment 4570 is an optional accessory that freezes material to a temperature of −30°C to −60°C. The metal Object Holder 4560 can be clamped easily into the attachment and the attachment mounted on any siphon carbon dioxide tank. When the tank valve is opened, a biscuit of dry ice is generated in a short time and the temperature of the specimen is lowered to −50°C to −60°C. If the temperature is too low for optimal cutting, the specimen can be allowed to warm to its optimal cutting temperature before sectioning is begun.

1-8 SPECIFICATIONS

Motor and Power Requirements:
Model 4553 - 115 VAC, 60 HZ @ 6 amp.
Locked Rotor - 43.0 amp.
Model 4554 - 220 VAC, 50 HZ @ 3.5 amp.
Locked Rotor - 19.0 amp.
Model 4558 - 220 VAC, 60 HZ @ 3.5 amp.
Locked Rotor - 19.0 amp.
Model 4559 - 100 VAC, 50 HZ @ 6 amp.
Locked Rotor - 43.0 amp.

Refrigeration Unit:
Hermetically sealed refrigeration unit including compressor and sealed refrigerant line containing Freon 12G refrigerant.

Shipping Weight:
Approximately 245 pounds (111.4 Kilograms)

Net Weight:
220 pounds (100 Kilograms)

Overall Dimensions:
48 inches (121.9 cm.) high; 26-1/2 inches (67.3 cm.) deep; 26-1/2 inches (67.3 cm.) wide.

LEGEND

1. Heat extractor
2. Cryobar
3. Freeze wells
4. Knife blade locking screws
5. Knife blade elevating screws
6. Angular reference
7. Gross adjusting wheel
8. Chuck knob
9. Chuck with object holder and specimen
10. Increment adjusting knob
11. Increment disengaging knob
12. Chuck locking lever
13. Bail type anti-roll device
14. Plate type anti-roll device

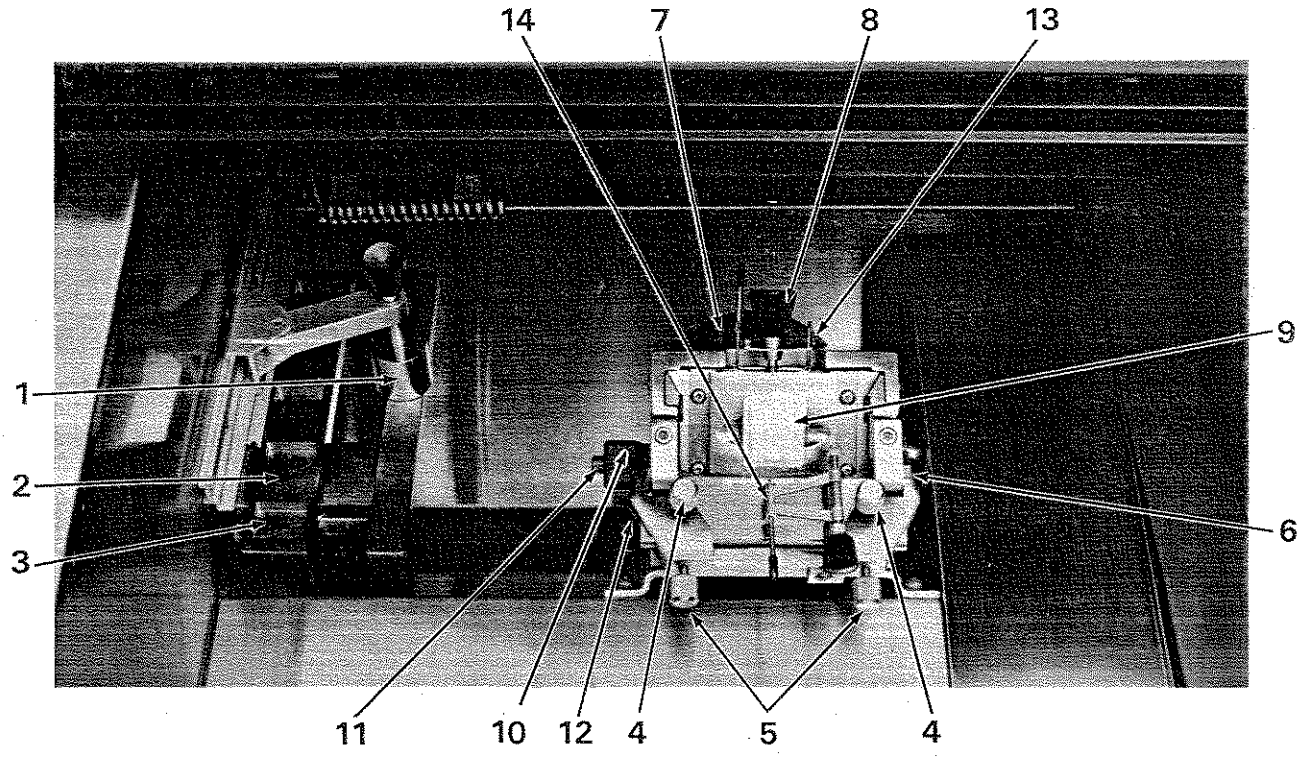


Figure 1-11
CRYOSTAT/MICROTOME COMPONENTS

SECTION 2 GENERAL MAINTENANCE

2-1 MICROTOME/CRYOSTAT OPERATING PROCEDURES

!WARNING!

If Microtome/Cryostat pathogenic contamination is suspected, see Paragraph 2-4-1.

NOTE: For general information on these procedures, review Paragraph 1-3-1-2.

2-1-1 Operation Outline

2-1-1-1 The following steps briefly outline the procedure for preparing TISSUE-TEK® II Microtome/Cryostat, freezing the specimen and cutting tissue sections:

1. Place knife blade in Microtome. — Paragraph 3-3-2.
2. Adjust cutting angle. — Paragraph 2-8-1.
3. Refrigerate Cryostat.
4. Precool object holder(s).
5. Mount specimen with O.C.T. compound, using either the conventional or frozen block procedure. — Paragraph 2-1-2.
6. Place object holder on Cryobar, with or without heat extractor, until tissue and O.C.T. compound are frozen.
7. Lock object holder in chuck. — Paragraph 2-1-3.
8. Position knife blade to chuck.
9. Set desired thickness of section in increment adjusting knob and engage automatic feed.
10. Position chosen anti-roll device. — Paragraphs 2-1-4 or 2-1-5.
11. Turn handwheel to cut sections.
12. Place sections on a slide after cutting.

2-1-2 Embedding and Freezing Tissue

2-1-2-1 Frozen Block Procedure: See Figure 1-3.

1. Place a few drops (1/16" or 2 millimeters) of absolute alcohol in the freeze well on Cryobar®
2. Select appropriate size Cryomold and add a thin layer of O.C.T. compound to the bottom.
3. Place tissue into the O.C.T. compound and orient to the desired plane of cutting.
4. Add additional O.C.T. compound over the tissue until a convex meniscus forms over the top of the inner compartment.
5. Place Cryomold into the freeze well. If using biopsy or intermediate Cryomold, insert appropriate adapter in freeze well to support Cryomold.
6. Press an inverted object holder into place on top of Cryomold. (O.C.T. compound should be observed protruding through the holes on the object holder. If O.C.T. compound protrudes excessively around the sides between the object holder and Cryomold, this may be an indication that too much has been added in Step 4.)

   NOTE: Allow the O.C.T. compound to extrude through the holes in the object holder. This will insure a firm frozen block that will not break loose from the object holder during the tissue sectioning.
7. Allow the specimen to remain in the well until frozen. O.C.T. compound extruding through holes will turn white and become solid.
8. Remove object holder from the well and peel off Cryomold.
9. Mount object holder in Microtome chuck.

2-1-2-2 Conventional Procedure:

1. Place an object holder on the Cryobar to cool.

   NOTE: Object holders can be stored on Cryobar and thus always be ready for use!
2. Select fresh unfixed tissue and cut to thickness of 2 to 50 millimeters.
3. Choose a precooled object holder from the Cryobar and warm its face slightly with the tip of a finger.
4. Place enough O.C.T. compound on the object holder to form a small semi-liquid matrix.
5. Mount tissue in the medium until completely embedded.
6. Replace the object holder on the Cryobar and place the heat extractor on top of the specimen — see Figure 1-3.
7. Remove the object holder from the Cryobar by turning the heat extractor knob clockwise.

2-1-3 Block Mounting and Cutting Procedure

2-1-3-1 This procedure describes mounting of an object holder with frozen specimen.

1. Lock the chuck in its uppermost position by turning the chuck locking lever down. This prevents the chuck from moving toward the knife blade while the object holder is being mounted in the chuck.
2. Mount the object holder with specimen in the chuck of the Microtome and tighten the chuck knob firmly to secure the holder in the chuck.

LEGEND

1. Thermostat temperature control knob
2. Black pointer — Sets chamber temperature
3. Blue pointer — Reads chamber temperature
4. Temperature scale
5. OFF-ON switch
6. TIME OF DAY dial
7. TIME OF DEFROST dial

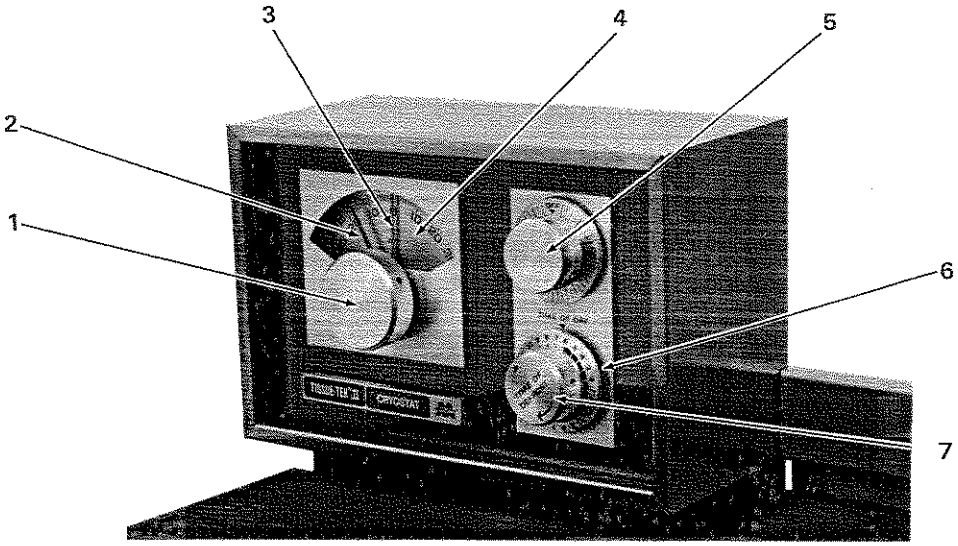


Figure 2-1
CRYOSTAT CONTROL PANEL

LEGEND

1. External chamber drain
2. Air ventilation grill
3. Rear compressor cover
4. Drain pan
5. Utility box cover
6. Ground fault circuit interrupt

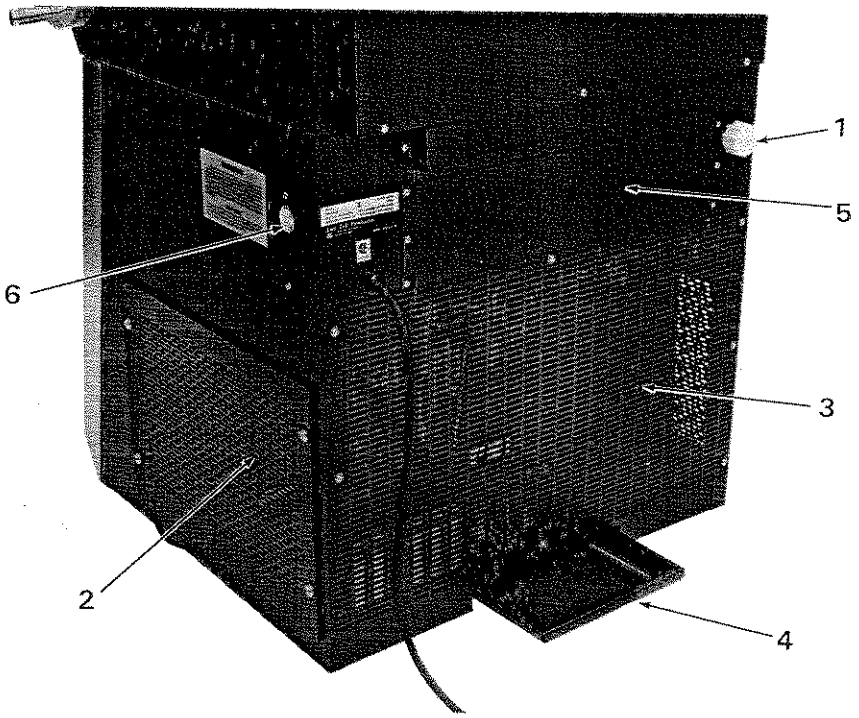


Figure 2-2
CRYOSTAT REAR

3. Disengage the automatic feed by pushing in the increment disengaging knob and turning it about 90° either way.
4. Release the chuck locking mechanism by pushing the chuck locking lever up.
5. Turn the gross adjusting wheel counterclockwise to bring the knife edge close to the tissue. If it becomes necessary to move the knife away from the tissue, the gross adjusting wheel can be turned clockwise to move the knife away from the chuck. If the disengaging knob has been pushed in, be sure to release it before trying to cut sections automatically.
6. Set desired increment of cut on the increment adjusting knob.
7. Use the handwheel and begin cutting sections. Full tissue sections will be cut within the first few strokes. Continue sectioning until the desired cutting area is reached. The handwheel motion should be free. If it is stiff or should it become stiff during operation, a drop of oil "A" on each point described in Paragraph 2-8-4 should free it.

2-1-4 Using Bail Type Anti-roll Device.

NOTE: An operator will need experience before good quality sections are achieved consistantly.

1. Warm the edge of the bail between the thumb and forefinger.
2. Adjust the bail so it rests about 1/8 inch below the bottom edge of the specimen (on the O.C.T. compound). Bail can be moved up or down.
3. Cut section by turning handwheel slowly and evenly.
4. Stop the handwheel just before the section is completely cut.
5. Gently lift the bail at the same time the cutting is being completed. With correct procedure, the cut section will adhere to and hang from the bail when it is lifted. Do not lift the bail suddenly or before handwheel is started or the bail may break free from the section

2-1-5 Using Plate Type Anti-roll Device

1. Lower plate to the surface of the knife blade. The plate should always be lowered and raised with the handle. If the plate itself is touched, it may become too warm and sections will stick to it rather than lie on the knife surface.
2. Turn the plate elevating knob so the top edge of the plate is slightly back of the cutting edge of the knife blade. Check to see the edge of the plate is parallel to the cutting edge of the knife blade. Parallelism can be achieved by loosening the knife blade holding screws and adjusting the blade elevating screws.
3. Proceed to cut sections.
4. As the sections are being cut, turn the plate elevating knob counterclockwise so the edge of the plate moves closer to the cutting edge of the knife blade. The plate edge may be slightly beyond the knife blade cutting edge before sections slide under the plate. If it becomes necessary to retract the plate during the adjustment, the plate should be lifted from the knife surface to prevent it or the knife blade from being damaged.
5. When sections begin to lie flat on the knife blade under the plate, stop adjusting the plate type anti-roll device.
6. Clean the knife blade and the plate type anti-roll device of all debris and return plate to its position on the knife.
7. Turn handwheel smoothly without pausing. With the plate anti-roll device, the handwheel can be turned more quickly than the bail type.
8. Lift plate. The section will remain on the surface of the knife blade.

2-2 GROUND FAULT CIRCUIT INTERRUPT CHECK

(115 VAC models only)

NOTE: Review Paragraph 1-4-1-1.

2-2-1 GFCI Self Test (Refer to Figure 2-2)

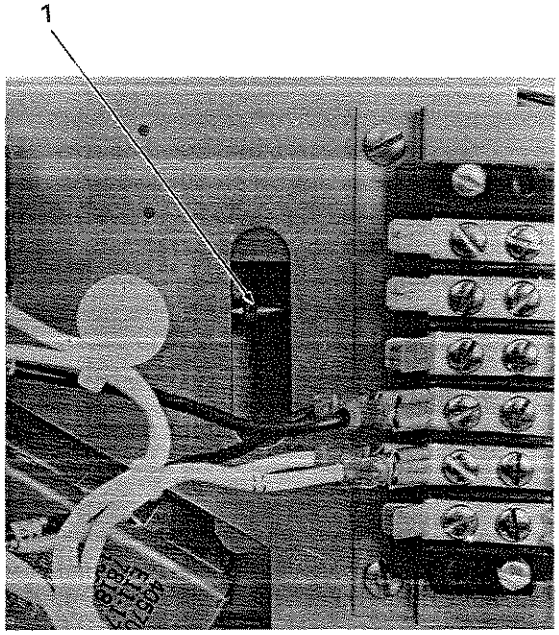
1. With Cryostat turned "on" and operating, test GFCI operation by pressing the GFCI TEST button.
2. RESET button should pop out exposing red band around it. Cryostat should stop operating.
   CAUTION: If red band does not show after pressing TEST button, immediately turn Cryostat "off" and remove line cord from AC outlet. Check Cryostat AC wiring and GFCI receptacle.
3. Restore normal operation by depressing the RESET button. Normal Cryostat operation should resume.

   If RESET button does not stay in, an instrument defect is indicated. Refer to Paragraph 1-4-1-1.

2-3 CONTROL PANEL OPERATION

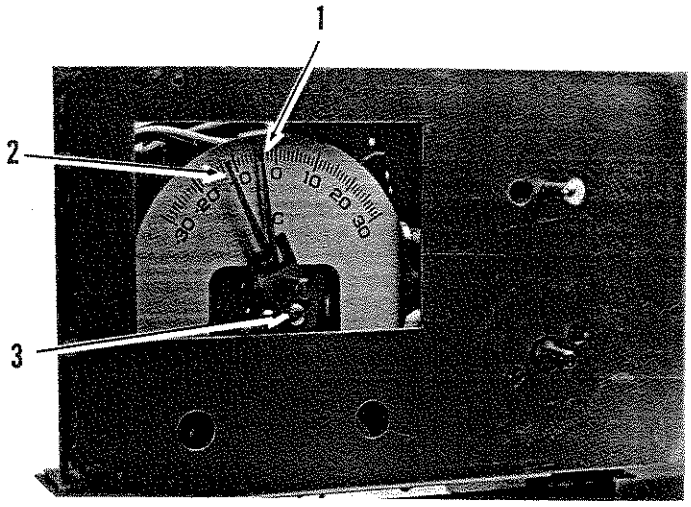
2-3-1 Setting Cryostat Defrost Cycle
(Refer to Figure 2-1)

1. Set defrost time by lining up the TIME OF DEFROST dial triangle to the desired defrost time on the TIME OF DAY control. Normally the defrost cycle is set to function at night.
   CAUTION: TIME OF DEFROST control turns clockwise only! Do not turn counterclockwise.
2. Set the TIME OF DAY dial so the correct time corresponds to the triangle on the control panel face.
3. The Cryostat will defrost every 24 hours at the selected time.



LEGEND
1. Temperature adjustment

Figure 2-3
THERMOSTAT CHAMBER TEMPERATURE ADJUSTMENT



LEGEND
1. Blue pointer — chamber temperature
2. Black pointer — selected chamber temperature
3. Locking screw

Figure 2-4
THERMOSTAT SELECTED TEMEPRATURE ADJUSTMENT

2-3-2 Setting Cryostat Temperature

2-3-2-1 The Temperature Control dial is set to the desired cutting temperature indicated by the thermostat black pointer. The thermostat blue pointer indicates the air temperature at blade level in the chamber.

2-4 CRYOSTAT CLEANING

2-4-1 Microtome/Cryostat Contamination

2-4-1-1 If Microtome/Cryostat pathogenic organism contamination is suspected, proper caution must be exercised. Contaminated components can be sterilized by any acceptable method. Proper protective clothing should be worn. Spraying contaminated components with a non-flammable, non-corrosive germicide before cleaning is suggested. The Microtome should be carefully removed from the Cryostat chamber and washed in an acceptable manner. The Cryostat chamber should be cleaned, washed and drained thoroughly.

NOTE: Autoclaving the Microtome is not recommended.

2-4-2 Cryostat Chamber Cleaning

2-4-2-1 The Cryostat chamber should only be cleaned when the chamber is at room temperature.

CAUTION: Allow Cryostat chamber to come to room temperature before removing Microtome — see Paragraph 3-3-1-1.

1. Refer to Figure 2-2. Remove external drain cap from rear of Cryostat.
2. Attach hose to drain.
3. Flush chamber with water.
4. Dry chamber thoroughly.

2-4-3 Compressor Lint Removal

2-4-3-1 For proper refrigeration efficiency the compressor condenser coils and air vents should be clean and free of lint.

1. Turn Cryostat "off."
2. Refer to Figure 2-2. Remove the two compressor air vent grills and rear compressor cover.
3. Vacuum dust and lint from the compressor area, vent louvers and condenser coil.

CAUTION: The Cryostat requires a 6 inch (15 cm) clearance on each side and rear for proper ventilation.

2-4-4 Removing CRYOBAR® Frost

NOTE: Use of the Cryobar cover will minimize Cryobar frost.

2-4-4-1 If the Cryostat is not used on a daily basis, there may be a tendency for frost to collect on the metal freezing areas of Cryobar. The frost, a result of Cryobar being maintained at −40°C, can readily be removed by the following procedure:

1. Place a few drops of absolute alcohol directly onto the freezing areas and/or freeze wells of Cryobar or onto a gauze pad.
2. Wipe the area free of frost with a gauze pad.
3. A thin layer of absolute alcohol should be allowed to remain in the freeze well(s), as it accelerates the freezing process.

NOTE: Direct contact of absolute alcohol with TISSUE-TEK II O.C.T. Compound may cause stickiness. Therefore, the Cryobar should be cleared of excess alcohol before use.

2-4-5 Drain Pan Cleaning (Refer to Figure 2-2)

2-4-5-1 The drainage of condensate and any waste materials during the defrost cycle is directed to a shallow drain pan. This drain pan is designed for fast evaporation of condensate, thereby eliminating possible bacterial build-up and/or unpleasant odors.

2-4-5-2 While the drain pan, located at the back of the instrument, is designed to be relatively maintenance-free, occasional cleaning may be desired. Simply remove the pan by pulling it out from the instrument. It may then be cleaned with a mild detergent and returned to Cryostat cabinet.

2-5 CONTROL OPERATIONAL CHECKS

2-5-1 Thermostat Operational Check and Adjustments

2-5-1-1 Thermostat Chamber Temperature Check (Blue Pointer): An accurate Celsius thermometer is required to make this check. Suspend the test thermometer bulb at approximately Microtome knife blade level. Do not allow the thermometer bulb to contact any surface within the chamber. Make the check in the −25°C region on the thermostat dial scale to assure accuracy.

1. Allow the Cryostat chamber to stabilize at approximately −28°C.
2. Check thermostat against thermometer. If adjustment is necessary, go to Step 3.
3. WARNING — The Cryostat should be turned "off" and the electrical line cord removed from the AC outlet for this adjustment.
4. Remove the six screws securing the control box rear cover.

!WARNING!

AC voltage is present on the control box terminal block if the instrument is plugged into AC outlet.

5. Refer to Figure 2-3. Using a 1/4 inch open end wrench, adjust the thermocouple tip nut for correct reading.

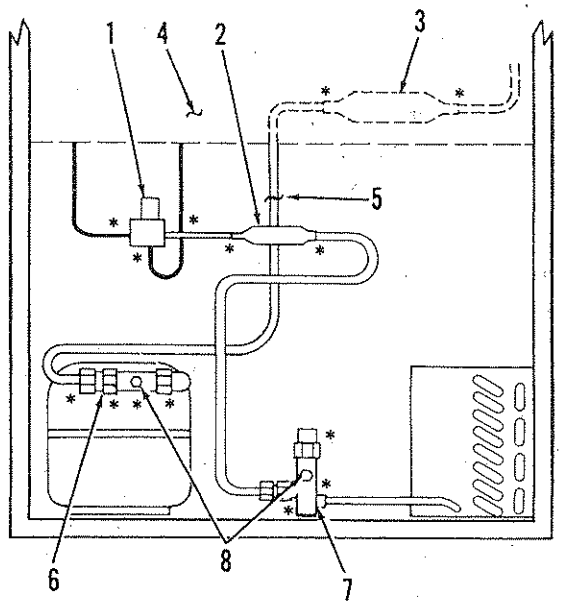
2-5-1-2 Thermostat Temperature Adjustment: Once the temperature in the chamber has stabilized, the blue pointer which indicates the chamber temperature should align with the black pointer of the temperature controller. If not, the black pointer should be adjusted. The chamber temperature (blue pointer) is presumed to be more correct than the selected temperature when a discrepancy exists. Paragraph 2-5-1-1 Chamber Temperature Check should be performed before this check.

1. Perform steps 1 through 7, Paragraph 3-2-4-1.
2. Replace the temperature control knob and ON-OFF knob.
3. Turn Cryostat "on" and allow chamber to stabilize at approximately −28°C.
4. Turn Cryostat "off."
5. Rotate black pointer toward blue pointer, listening closely for a "click." Note point at which "click" occurs.
6. Rotate black pointer slowly in opposite direction until second "click" is heard. Set black pointer midway between the two points where "clicks" occur.
7. Refer to Figure 2-4. Loosen lock screw in black pointer and align black pointer with blue pointer. Tighten lock screw.
8. Reassemble control box by reversing steps 1 through 9, Paragraph 3-2-4-1. Adjust TIME OF DEFROST knob (step 9) as described.

2-5-2 Time of Defrost Control Check

2-5-2-1 The TIME OF DEFROST knob must be secured on the control shaft. When the knob is turned (clockwise only) the TIME OF DAY dial must turn with it.

1. Turn the Cryostat "on" and allow the chamber to cool down to 0°C or below.
2. Turn the TIME OF DEFROST clockwise only until a click is heard and the Cryostat turns off. The scribed line on the knob should align closely with the TIME OF DAY triangle on the face plate when the click occurs. If not, adjust the TIME OF DEFROST knob as described in the following Step 4.
3. During the defrost cycle all five heaters should be on:
   a. defrost heater — bottom of evaporator coils.
   b. pan heater — bottom of pan.
   also:
   c. trim heater and top heater.
   d. window heater.
4. Adjust the TIME OF DEFROST knob as follows:
   a. Select a defrost time. Carefully turn the TIME OF DEFROST knob until a click is heard.
   b. Loosen the TIME OF DEFROST knob setscrews. Rotate knob until scribed line aligns with TIME OF DAY triangle on face plate.
   c. Hold this position and secure setscrews. Make sure knob is far enough back on shaft to turn the TIME OF DAY dial.
   d. Recheck knob scribe line alignment to triangle.



LEGEND

1. Solenoid valve
2. Filter-Drier
3. Accumulator
4. Foam insulation area
5. Normal frost line (Heat exchanger tube)
6. Compressor low side valve
7. Compressor high side valve
8. Manifold connector fittings

* Freon leak points

Figure 2-5
CRYOSTAT REFRIGERATION SYSTEM
ACCESSIBLE FREON LEAKAGE POINTS

2-6 COMPRESSOR REFRIGERATION SYSTEM CHECK/CHARGE

NOTE: It is suggested that Cryostat refrigeration system servicing be performed by experienced refrigeration servicing personnel.

NOTE: Lint and dust air blockage in the compressor condenser coils is often a major cause of poor cooling — see Paragraph 2-4-3.

NOTE: The Cryostat refrigeration flow system is illustrated in Figure 1-6, Section 1.

2-6-1 Refrigeration System Check

2-6-1-1 If the Cryostat refrigeration system is not operationg properly, review Symptoms "F" and "G," Section 4, Cryostat Troubleshooting.

1. If operation appears normal, a check on the compressor charge can be made by performing the following steps of Paragraph 2-6-2:
   Step 1
   Step 2
   Step 4
   Step 5
2. The charge and temperature conditions should be as follows:
   a. Low pressure side should indicate 8-10 inches of mercury.
   b. High pressure side should indicate 85-100 psi.

   System restriction: If low side vacuum rises above 10 in. Hg. and high side rises above 110 psi, a refrigeration system restriction may exist.
   System overcharge: An overcharged system will not cool to −30°C and may generally result in a large frost line — see Paragraph 1-5-2-2.

TO CONVERT	INTO	MULTIPLY BY
inches of mercury	atmospheres	0.03342
inches of mercury	kgs/sq cm	0.03453
inches of mercury	kgs/sq meter	345.3
inches of mercury	pounds/sq ft	70.73
inches of mercury	pounds/sq in.	0.4912
pounds/sq in.	atmospheres	0.06804
pounds/sq in.	feet of water	2.307
pounds/sq in.	inches of mercury	2.036
pounds/sq in.	kgs/sq meter	703.1

TABLE 2-1
PRESSURE CONVERSION

2-6-2 Refrigeration System Charging

2-6-2-1 This procedure is a general Cryostat refrigeration system recharging procedure. Correct equipment is required. A professional recharging system may be used, however, overcharging of the system is cautioned. The system should always be vacuumed prior to recharging.

Tools Required: Vacuum pump
14 oz. can of Freon "12"
Valve Tool
Manifold vacuum/pressure charging kit (with gauges)

Field connections: Low side 3/8 flare
High side 1/4 flare

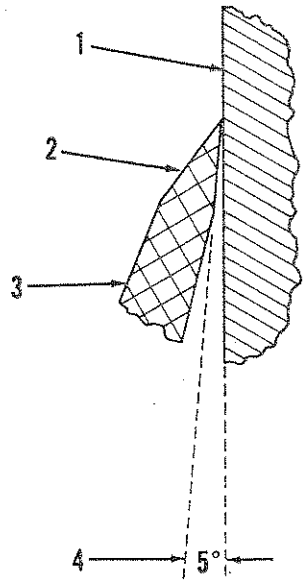
1. Turn Cryostat "off."
2. Refer to Figure 2-5 or Figure 3-6. Remove the Compressor low pressure side caps from the valve and manifold fittings.
3. Using a vacuum pump, vacuum compressor to 30 inches of mercury (Hg.).
   NOTE: For conversions see Table 2-1. If an apparent leak exists, see Paragraph 2-6-1.

NOTE: The following step is important for proper Cryostat charging.

4. Connect freon charging system to compressor low pressure side. Open low side valve.
   NOTE: A pressure monitoring gauge may be connected to compressor high pressure side if desired. Open high side valve.
5. Turn Cryostat "on" and set thermostat to −30°C.
6. Charge compressor with 14 oz. of freon "12" gas only. This should create 8 - 10 inches of mercury on low pressure side. High pressure side should be approximately 85 psi.
   NOTE: If 14 oz. can of freon "12" is used, it may be necessary to warm can and turn upside down in order to get freon out. Use warm water or roll can between warmed hands. When can is empty, charging is complete.

CAUTION — If the charge can not be obtained as described in this step, see Paragraph 2-6-1-1.

7. When charging is complete, shut compressor valve and remove charging system.
8. Operate Cryostat and check for proper cooling.
   NOTE: If apparent leaking occurs, see Paragraph 2-6-3.



LEGEND

1. Tissue surface
2. Bevel of knife blade edge
3. Knife blade
4. Clearance angle between tissue surface and bevel of knife blade edge.

Figure 2-6
MICROTOME KNIFE BLADE RECOMMENDED CLEARANCE ANGLE

LEGEND

1. Blade holder locking screw
2. Rotating axis
3. Angular reference
4. Blade locking knob
5. Blade holder
6. Blade elevating knobs

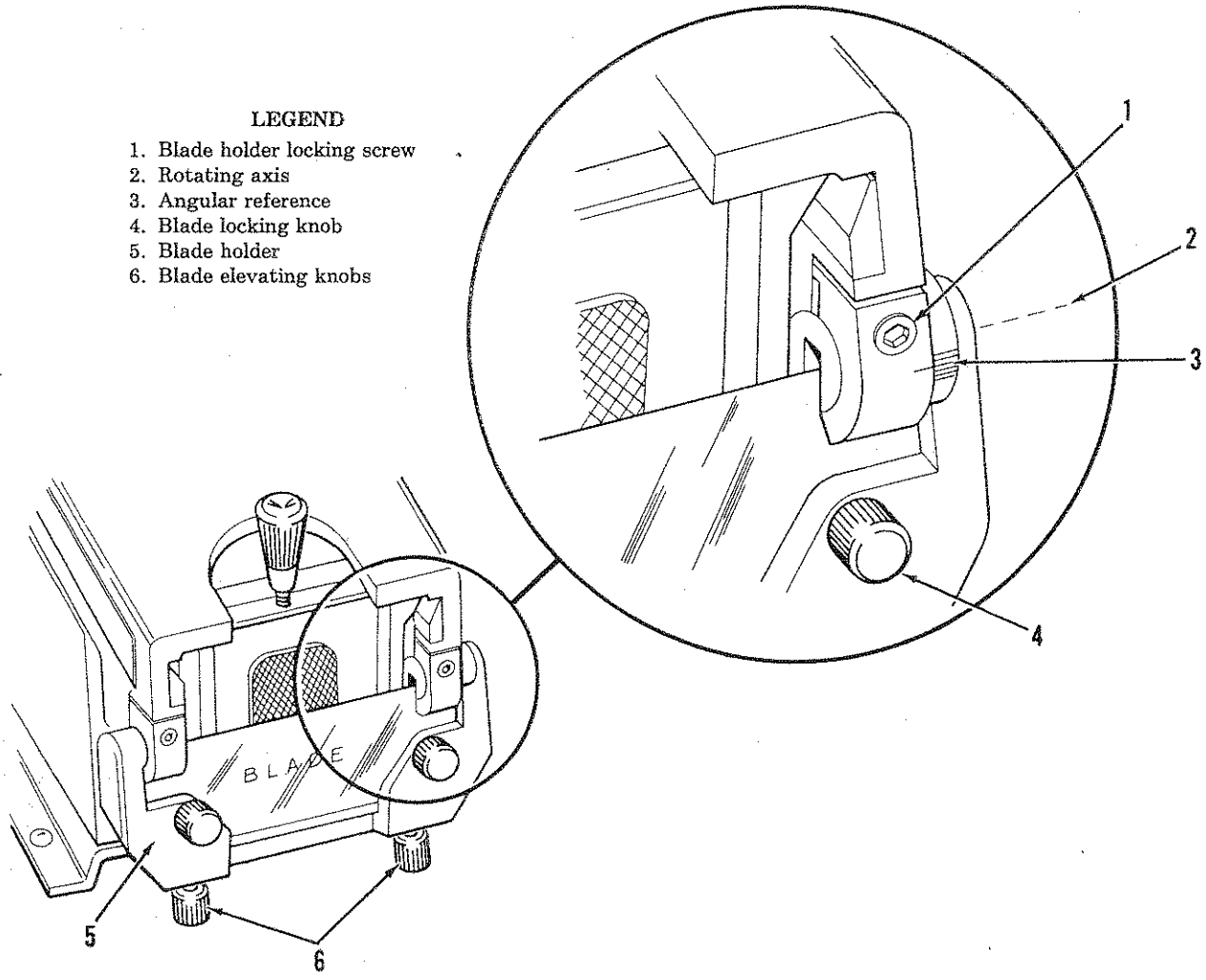


Figure 2-7
MICROTOME KNIFE BLADE ADJUSTMENT

2-6-3 Refrigeration System Leakage

2-6-3-1 If the Cryostat compressor appears to operate satisfactorily but no cooling or inefficient cooling occurs, a system freon leak may exist — review symptom G, Section 4, Cryostat Troubleshooting.

2-6-3-2 Refer to Figure 2-5. Much of the Cryostat refrigeration system is sealed within insulating foam and is inaccessible for servicing. If a leak occurs the system will normally discharge within hours. A small leak will require more time. The evaporator and heater assembly (5-1-51) is replaceable; however, experience working with refrigeration systems is necessary. Contact Ames/Lab-Tek Service on these problems — See Paragraph 1-1-1.

!WARNING!

Cryostat insulation foam is flammable. Do not use flame type freon detectors. If any open flame soldering is done, use asbestos paper behind soldering area. The foam insulation is made of a freon base material which makes gas type freon detectors ineffective. Points within the insulated foam area where leaks may occur include the cold bar casting and accumulator solder points. The portion of the refrigeration system located in the compressor area is accessible for checking. Possible leakage points here include solenoid valve and filter/drier solder points; compressor tubing connector, manifold fittings and valve controls. On valves, seatings may be tightened.

2-7 CRYOSTAT ELECTRICAL COMPONENT RESISTANCE CHECKS

2-7-1 The following components may be checked for correct or normal resistance. Isolate component by removing at least one wire lead connector. Use the wire installation diagrams — Section 6.

1. Defrost Timer (50/60 Hz) — 1kΩ
   a. Wire leads 51 - 53.
   b. Pins 1 - 3
2. Relay R1 (115 VAC) — 2kΩ
   a. Wire leads 34 & 37.

   Relay R1 (100 VAC 50 Hz) — 175 to 240Ω
   a. Wire leads 34 & 37.
3. Relay R2 (115 VAC) — 290Ω
   a. Wire leads 40 & 57.
4. Compressor and fan (115 VAC) — 2Ω
   a. Wire leads 40 & 45.
5. Chamber OPT — 0
   a. Wire leads 10 & 10.
6. Defrost heater (115 VAC) — 25Ω to 33Ω
   a. Wire leads 10 & 13.
7. Trim heater — 250Ω
   a. Wire Leads 14 & 16.
8. Top heater — 120Ω
   a. Wire leads 16 & 54.

9. Pan heater — 170Ω
   a. Wire leads 15 & 20.
10. Window heater — 600Ω
    a. Wire leads 8 & 9.
    NOTE - Window has plug connector.
11. Solenoid valve coil — 400Ω
    a. Wire leads 32 & 36.
12. Ballast:
    a. Wire leads 33 & 35 (Input) — 25Ω
    b. Wire leads 1 & 2 — 5Ω
    c. Wire leads 3 & 4 — 5Ω
13. Isolation transformer
    a. Wire leads 43 & 44 dual primary winding
       115 VAC — 40Ω each winding
       220 VAC — 80Ω
       (40Ω per winding)
    b. Wire leads 41 & 42 secondary winding — 30Ω
14. Power transformer (220 VAC Models)
    a. Wire leads 57 & 59 — 3Ω
    b. Wire leads 57 & 58 — 3Ω
    c. Wire leads 57 & 63 — 3Ω (50 Hz)

2-8 MICROTOME MAINTENANCE

!WARNING!

Use caution when working with the Microtome. Remove the knife blade if necessary. If Microtome is cold, use precautionary measures for working with cold steel. If pathogenic contamination is suspected, see Paragraph 2-4-1.

2-8-1 Microtome Knife Blade Adjustment

2-8-1-1 Knife blade height and cutting angle are user preferences. Experience is necessary before good cutting is obtained. The angle of the knife to the tissue surface can vary to some extent. If, however, the angle is too acute and does not allow clearance for the bevel of the cutting edge, the knife may compress the tissue causing skipped sections and, when the compressed material springs back, sections too thick may result. If the angle between the knife blade and the tissue surface is too great, the blade edge may scrape the tissue rather than cut it. It is usually recommended at least a 5 degree clearance angle be allowed between the bevel of the knife edge and the surface of the tissue being cut (See Figure 2-6).

1. The knife blade must be installed and secured (See Paragraph 3-3-2, Step 5).
2. Refer to Figure 2-7. Loosen the blade holder locking screws with an allen wrench.
3. Adjust cutting angle by raising or lowering the blade holder around its rotating axis. Use angular reference to set angle.
4. Secure blade cutting angle by tightening locking screws.

LEGEND

1. Washers
2. Ratchet wheel
3. Lead screw
4. Pawl arm
5. Pawl
6. Ratchet pin
7. Increment knob

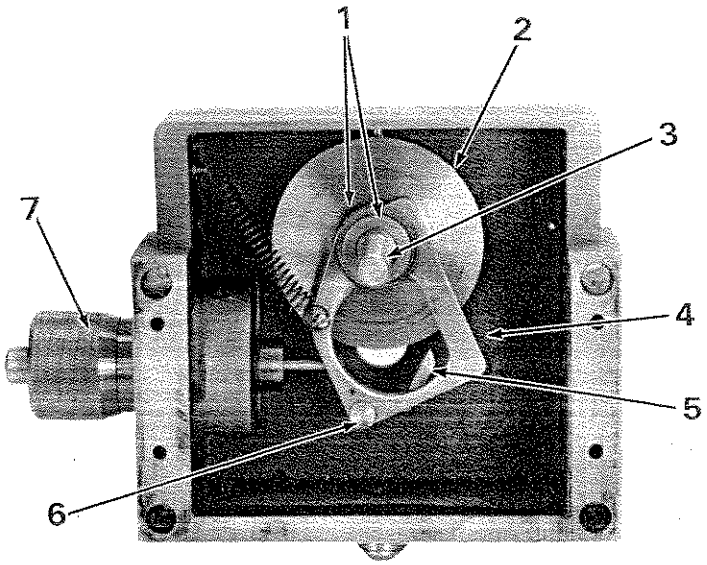
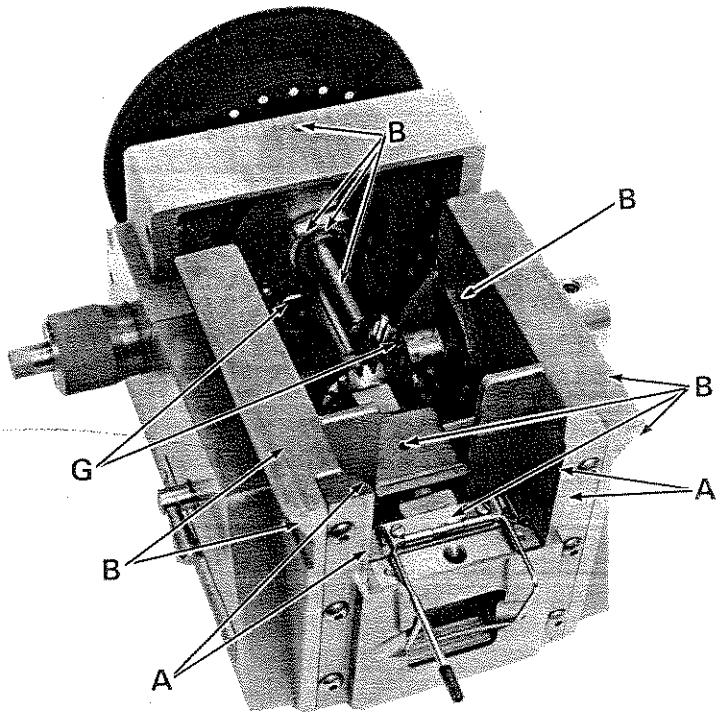


Figure 2-8
MICROTOME BACK HOUSING CLEANING



NOTES:

1. Place oil "B" into crank roller oil port under bail anti-roll assembly mounting plate.
2. On Microtome instruments with the rear bearing block installed, place "B" oil on block bearing hole.

Figure 2-9
MICROTOME LUBRICATION POINTS — TOP SLIDER ASSEMBLY REMOVED

2-8-2 Microtome Knife Blade Sharpening

2-8-2-1 The knife blade must be sharp, smooth and free of dirt or debris. If the knife is dull, sections may tear or be compressed. Nicks in the blade may cause tearing or scoring of the sections. Dirt or debris on the surface of the blade may cause sections to stick and fold or tear. Techniques for sharpening the knife are described in the TISSUE-TEK II Microtome/Cryostat Operating Manual.

2-8-3 Microtome Daily Lubrication

2-8-3-1 In day-to-day operation, Lubricant Oil "A" must be applied daily to maintain an even cutting action. More frequent lubrication of these surfaces may be necessary depending upon Microtome use. This requirement can only be determined through ease of Microtome usage.

1. Refer to Figure 2-9. Lower the chuck to its lowest position exposing vertical gibs.
2. Place "A" oil on the chuck traveling surfaces of the two vertical gibs marked "A."

2-8-4 Microtome Cleaning and Lubrication

2-8-4-1 The Microtome must be cleaned and lubricated periodically. Cleaning and lubricating techniques should be reviewed with operating personnel. Emphasis should be placed on the importance of cleaning and lubricating the Microtome at regular intervals. Procedures to clean and lubricate the Microtome are also given in the Operating Manual.

1. Remove Microtome from Cryostat as described in Paragraph 3-3-1.
2. If Microtome was removed from the cooled Cryostat, allow to come to room temperature. Condensation will cover instrument including moving parts.
3. Remove the top slider from the Microtome as described in Paragraph 3-3-3.
4. If Microtome has heavy debris contents, remove the back housing assembly from the lower slide and gear assembly as described in Paragraph 3-3-4.
5. Remove debris from Microtome components using cotton swabs. Remove moisture by wiping with moisture absorbing towels. Clear the gibs, gears, crank arm and roller.
6. Refer to Figure 2-8. Clean the back housing, ratchet wheel, pawl arm and pawl. The fine teeth of the ratchet wheel and lead screw threads must be free of moisture. The pawl must be clean, move freely and spring back. A drop of "B" oil on pawl pivit pin will help prevent freezing.
7. Turn increment knob counterclockwise and remove from gear housing:
   a. Press increment disengaging knob several times to make sure there is no moisture to impair operation.
   b. If necessary, remove the two socket head screws and disassemble increment knob assembly. Clean, dry and reassemble.
   c. Place a few drops of oil "B" down the disengaging rod to prevent increment freezing.
   d. Place "G" grease on knob threads.
   e. Install increment knob in gear housing.
8. If moisture cannot be fully removed from any Microtome component, immerse component into 100% alcohol. Allow to soak three (3) minutes. Remove from alcohol and allow to dry.
   CAUTION — Make sure all alcohol has evaporated from all surfaces. Microtome must be completely relubricated as described in Step 6, Step 7 and Step 10.
9. If Step 4 was performed, reassemble the back housing assembly on the lower slide and gear assembly.

Refer to Figure 2-9 for following step.

10. Place Oil "A" on the two vertical steel gibs marked "A," Oil "B" on all surfaces marked "B" and put "G" grease on the two surfaces marked "G."
    CAUTION — Make sure Oil "B" enters the lubricating ports, including the crank roller port. Air bubbles may develop which could prevent Oil "B" from reaching bearing. If this happens, a plastic pasteur pipette may be used to fill lubricating port with Oil "B." "B" oil must also be placed on horizontal gib sliding surface. Place Oil "A" on the buffer pins and springs.
11. Install top slider assembly as described in Paragraph 3-3-3, Step 7.
12. Operate Microtome and check for proper operation.
13. Install Microtome in Cryostat as described in Paragraph 3-3-2.
14. Allow Microtome to cool to operating temperature. Check Microtome operation at cooled temperature.

LEGEND

1. Gib adjusting screw
2. Incorrect — gib bowed inward top and bottom
3. Incorrect — gib bowed inward at center

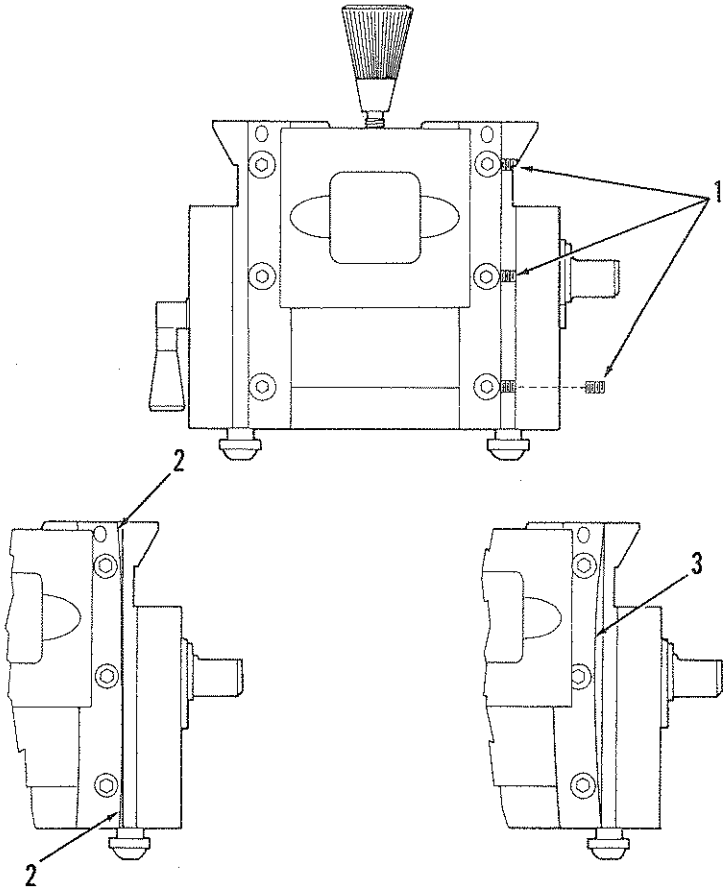


Figure 2-10
MICROTOME VERTICAL GIB ADJUSTMENT

LEGEND

1. Clearance — gib to top slider
2. No side play

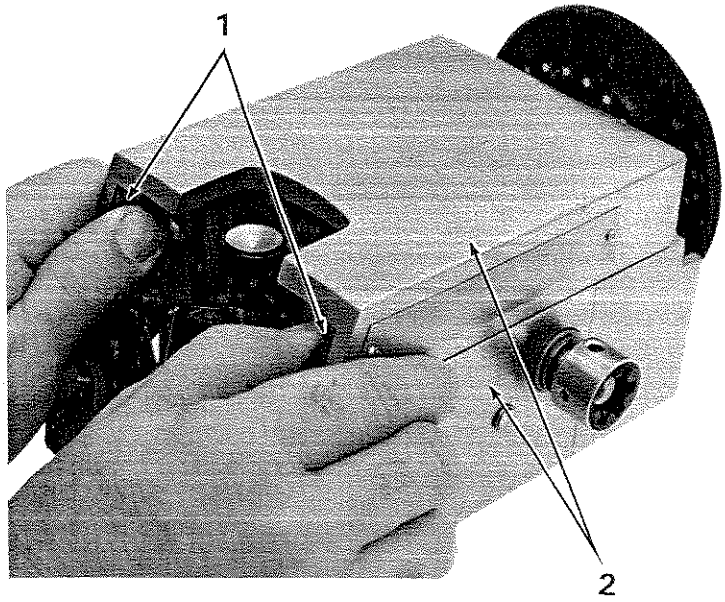


Figure 2-11
MICROTOME HORIZONTAL GIB ADJUSTMENT CHECK

2-8-5 Right Vertical Gib Adjustment

NOTE — The vertical gib may be adjusted with the Microtome in the Cryostat and cooled or removed from the Cryostat. If removing Microtome, see Paragraph 3-3-1.

2-8-5-1 The vertical gibs are properly adjusted when the chuck moves through its entire length of travel with no binding and with no extra movement. Indications that the vertical gibs require adjusting are too much play in the Microtome chuck or cut tissue sections of uneven thickness. To check adjustment, hold the chuck at top and bottom and attempt to move in any direction other than straight up and down. If movement other than up and down is possible, chuck requires adjustment. Placing Microtome oil between chuck ways and gibs will help to indicate excessive movement. If chuck is loose, the oil will flicker along edge of the chuck when pressure is applied from side to side. Check should be made when chuck is at the uppermost, center and bottom positions. The following adjustments are precise and should be made very carefully. **This adjustment is one of the most critical adjustments on the Microtome.**

CAUTION — Gibs must be properly lubricated before check and adjustment — see Paragraph 2-8-4.

Tool Required: Allen wrench

1. Remove the top slider assembly from the Microtome as described in Paragraph 3-3-3.
   NOTE — If the Microtome needs cleaning and lubrication, see Paragraph 2-8-4.
2. Turn handwheel shaft to move chuck up and down.
   a. Check for play in chuck. If chuck movement is unusually free or loose, right vertical gib should be adjusted. If chuck binds, gib needs adjustment.
3. Refer to Figure 2-10. To adjust right vertical gib:
   a. Loose chuck — tighten setscrews very lightly in 1, 2, 3 sequence. Repeat until chuck movement binds.
   b. Binding chuck — loosen setscrew in area of bind and tighten remaining setscrews equal amounts.

   CAUTION — Make sure gib does not bow.
   c. If bind does not release, it may be necessary to tap edge of gib in binding area with a small, soft mallet.
4. Recheck travel of chuck in gibs. If movement is still too free, repeat Step 3. Repeat until there is no binding, sticking or looseness.
5. Check operation of Microtome (cooled) in Cryostat. Adjustments should be maintained since Microtome components contract at same rate.

2-8-6 Horizontal Gibs Adjustment

NOTE — Horizontal gibs may be adjusted with the Microtome in the Cryostat and cooled or removed from the Cryostat. If removing Microtome, see Paragraph 3-3-1.

2-8-6-1 Excessive play in the movement of the top slider assembly is an indication the horizontal gibs need adjustment. Refer to Figure 2-11.

CAUTION — Gibs must be properly lubricated before check and adjustment. See Paragraph 2-8-4.

1. Clearance between gib and top slider should be approximately the same on both sides.
2. There should be no side play between top slider and gib ways.

2-8-6-2 To verify that adjustment of the gibs is necessary, make the following "snap back" check:

1. Rotate gross adjustment wheel and position top slider 1/4 inch from end of back housing.

Refer to Figure 2-12 for following steps.

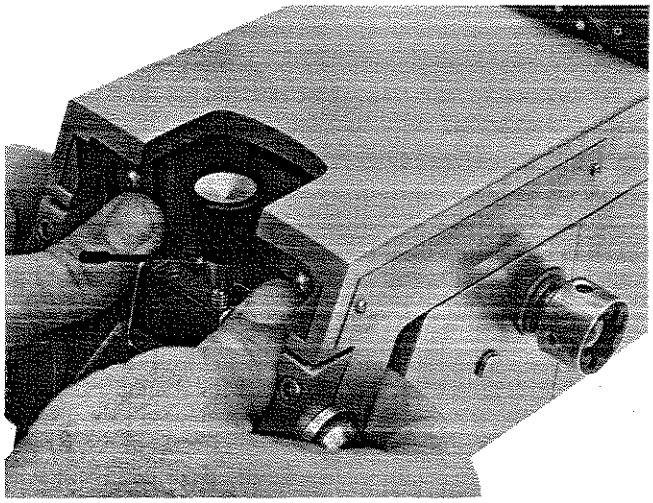
2. Press top slider back toward gross adjustment wheel. Top slider should remain in this position when released — gib adjustment is okay. If top slider snaps back on its own accord — gib adjustment is required.
3. Pull top slider toward its original position. It should only require a slight press to cause top slider to snap back.

2-8-6-3 To adjust Horizontal Gibs:

Tools Required: Small screwdriver
Allen wrench

1. Remove the two gib screw cover plates from the side of the Microtome top slider.
2. Leave top slider in position 1/4 inch from end of back housing.
3. Adjust setscrews. The gap between the side of the gib and top slider should be approximately the same on both sides before and after adjustment.
   a. Tighten the six setscrews (in small increments) in the sequence shown in Figure 2-13. Tighten each setscrew until a slight resistance is felt indicating spring is against gib.
   b. Check snap back effect as described in Steps 2 and 3, Paragraph 2-8-6-2.
   c. There should be no side play between top slider and gibs.
4. Rotate gross adjustment wheel and remove top slider from lead screw. Top slider should move smoothly in area near end of lead screw. Top slider may be difficult to remove from gear box since gear box may spring outward near vertical gib area.
5. Repeat gib screw adjustment as described until adjustment checks are correct.
6. Check operation of Microtome (cooled) in Cryostat. Adjustments should be maintained since all Microtome components contract at the same rate.

STEP 2



STEP 3

Figure 2-12
TOP SLIDER SNAP BACK CHECK

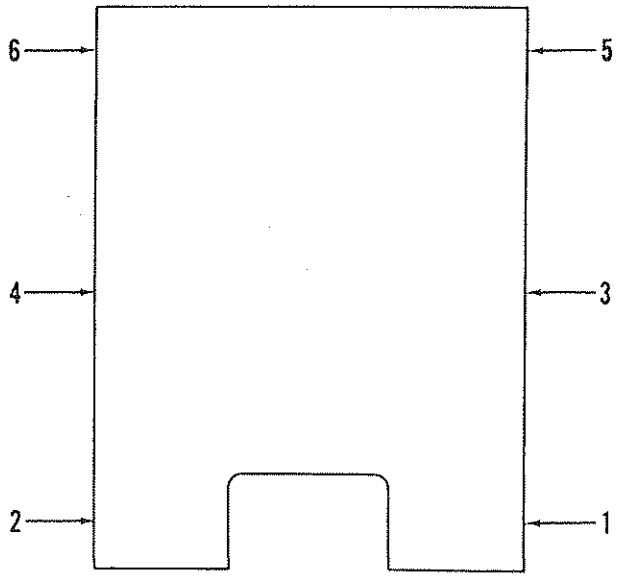


Figure 2-13
SCREW ADJUSTMENT SEQUENCE FOR HORIZONTAL GIBS ADJUSTMENT

2-8-7 Chuck Jaw and Riser Adjustment

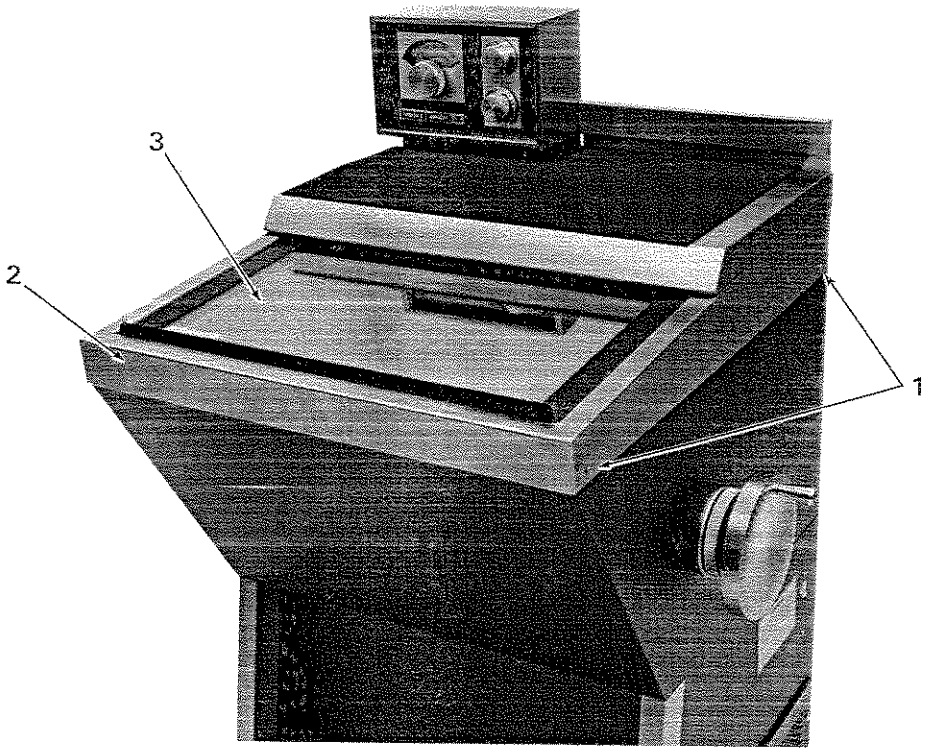
2-8-7-1 Refer to Figure 5-4. The screws (-109) holding the chuck jaw (-108) and chuck riser (-105) are inserted from bottom of chuck through chuck jaw, springs (-107), chuck (-106) and into chuck riser. Normal adjustment will leave the screws just below the surface of the riser (-105). Improper adjustment of screws will result in following conditions:

1. If screws are inserted too far (extend above riser), the chuck jaw may not open far enough to receive specimen object holder.
2. If screws are not inserted far enough, the chuck jaw may not tighten on object holder. The riser may extend high enough to hold bail anti-roll wire away from specimen.
3. If screws are inserted unevenly, only one side of jaw will be holding object holder, allowing possible movement of holder while sectioning.

2-8-8 Drag Spring Tension Adjustment

2-8-8-1 Refer to Figure 3-14. The gross adjustment drag spring should be adjusted so spring plastic head is properly against wheel. The spring should not be bowed raising plastic head from wheel.

1. Loosen the drag spring adjustment screw until spring plastic drag head is not in contact with gross adjusting wheel.
2. Turn in setscrew until plastic drag head contacts wheel.
3. Turn setscrew an additional one-half (1/2) turn.



LEGEND

1. Securing screw — Hood
2. Hood & Trim Assembly
3. Sliding window (door)
4. Fluorescent bulb
5. Door switch
6. Screw — Hood-to-trim
7. Light pan support assembly
8. Trim and top heater assembly
9. Window cord/clip

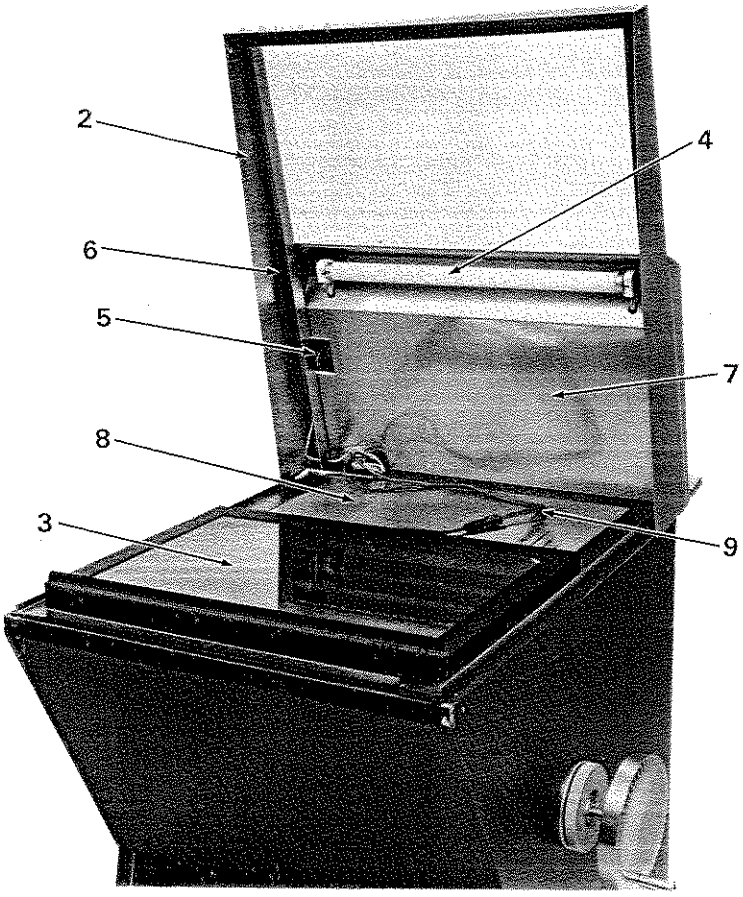


Figure 3-1
CRYOSTAT DISASSEMBLY

SECTION 3 REPAIR

3-1 REPAIR

3-1-1 This section details Cryostat and Microtome removal, disassembly and replacement procedures.

!WARNING!

If Microtome/Cryostat pathogenic contamination is suspected, see Paragraph 2-4-1.

!WARNING!

Always turn electrical power "off" and unplug line cord from elecrical outlet when inside instrument.

3-2 CRYOSTAT REPAIR

3-2-1 Replacement of Fluorescent Bulb

Tool Required: Screwdriver

1. WARNING — Turn the CRYOSTAT "off" and remove electrical line cord from AC outlet.
2. Remove the four Hood and Trim Assembly slotted securing screws (two each side) — see Figure 3-1.
3. Carefully pivot the Hood Assembly upward to expose underside. Prop the trim in the raised position.
4. Replace fluorescent bulb.
5. Lower the Hood and Trim Assembly into the proper mounted position.
6. Plug line cord in and turn CRYOSTAT "on."
7. Open sliding window to test bulb.
8. Install securing screws removed in Step 2.

3-2-2 Removal of Sliding Door

Tool Required: Screwdriver

1. Lift the Hood and Trim Assembly as described in Paragraph 3-2-1 above, Steps 1 through 3.
2. Disconnect door electrical lead connector and remove door.
3. Replace door by reversing Steps 1 and 2. Dress electrical leads to allow door to slide back freely.

3-2-3 Replacement of Door Switch

3-2-3-1 Replacement of the door switch requires removal of the light pan support assembly — see Figure 3-1. To remove this item requires removal of the connecting wire leads from the hood rear opening. Refer to the CRYOSTAT Wiring Diagrams at the back of this manual.

Tool Required: Screwdriver

1. Lift the Hood and Trim Assembly as described in Paragraph 3-2-1 above, Steps 1 through 3.
2. Refer to Figure 3-1. Remove the four screws (3-1-6) securing the top trim to the hood. Carefully lower the trim allowing the hood to remain raised.
3. Remove the two screws from the hood rear securing the light pan support assembly and rear rail.

   NOTE — Rear rail may be removed by removing single screw securing rail to control box.
4. Remove back cover assembly from instrument.
5. Cut the required lead ties (5-3-34) and remove the hood opening wire leads from the terminal block. Work the leads through the hood opening — see Figure 3-3.
6. Remove the light pan and replace switch.
7. Reassemble instrument by reversing above Steps.

3-2-4 Replacement of Cryostat Operating Controls

3-2-4-1 Control Box Housing Removal:

Tool Required: Screwdriver

1. WARNING: Turn CRYOSTAT "off" and remove electrical line core from AC outlet.
2. Remove the six screws securing the control box rear cover.
3. Remove the single screw attaching control box housing to the rear rail.
4. Carefully slide housing fully forward to clear base flange. Lift up to remove.
5. Loosen setscrews in control knobs and remove knobs. Remove spacer from TIME OF DEFROST timer shaft. Note spacer orientation on timer shaft — see Figure 5-2-8.
6. Separate electrical tape from edge of plastic instrument face.
7. Remove plastic instrument face and instrument face housing from chassis.
8. Reassemble control box by reversing above steps.

   NOTE — Install TIME OF DEFROST knob spacer correctly. Tighten knob setscrews on flats of shafts.
9. Adjust the TIME OF DEFROST knob as described in Paragraph 2-5-2.

3-2-4-2 OFF/ON Switch Replacement:

Tools Required: Screwdriver
Pliers

1. Disconnect leads from switch terminals.
2. Insert a screwdriver through holes in front face of chassis and remove two switch mounting screws.
3. Withdraw switch to rear of chassis.
4. Insert shaft of new switch through bores in mounting plate and chassis and align to mounting screw holes. Install and secure mounting screws.
5. Connect electrical leads to switch terminals.
6. Assemble control box housing in reverse order of disassembly.

3-2-4-3 Time of Defrost Control Replacement:

Tools Required: Screwdriver
Heater blower
Pliers

1. Remove back cover assembly from instrument.
2. Refer to Figure 3-2. Disconnect four leads from the defrost timer terminals. Note terminal number of each lead before disconnecting.
3. Carefully note routing of capillary tube from control to evaporator in chamber. Cut the necessary lead ties and remove plastic cable clips.
4. Remove the no drip tape from chamber opening — Refer to Figure 3-3.
   NOTE: No drip tape may be softened by using hot blown air from a heater blower.
5. Refer to Figure 3-1. Lift the Hood and Trim Assembly as described in Paragraph 3-2-1, Steps 1 through 3.
6. Disconnect door electrical lead connector and remove sliding door. Remove the window heater cord assembly from cable clip.
7. CAUTION: During this step, use caution when lifting the trim and heater assembly. The top heater wire leads are tight at the rear right. It may be necessary to provide slack in these wires. The rubber insulation strips should not be secured to the trim but in some cases may be. If necessary loosen trim with screwdriver.
   Lift and remove the trim and heater assembly.
8. Remove capillary tube from evaporator and remove from instrument.
9. Remove TIME OF DEFROST control from control box chassis with capillary tube.
10. Install replacement control by reversing the above steps:
    a. Route capillary tube in same manner as original tube.
    b. Twist capillary tube evaporator securing wires tightly to achieve good capillary tube contact to evaporator fins.
    c. Make sure trim/heater and hood/trim assemblies are properly seated.
    d. Properly seal chamber opening with no drip tape.
11. Reassemble control box by reversing Steps 1 through 9, Paragraph 3-2-4-1. Adjust TIME OF DEFROST knob (Step 9).

3-2-4-4 Thermostat Assembly Replacement:

Tools Required: Screwdriver
Heater blower

NOTE: The thermostat assembly capillary tube bulb is the spiral wound assembly mounted in the bulb bracket located at the evaporator left front — see Figure 1-2.

1. Perform Steps 1, 3, 4, 5, 6 and 7, Paragraph 3-2-4-3. During Step 7, remove the Oven Temperature Protector (OTP) from the CRYOSTAT Chamber — see Paragraph 3-2-6.
2. Remove the thermostat capillary tubing from the two interior cable clips.
3. Remove the thermostat bulb from its mounted position. Work bulb and tube through snap bushing and remove from chamber.
4. Refer to figure 3-2. Remove the 2 top screws securing the control mounting plate to the control chassis. Loosen the 2 bottom screws.
5. Remove the two screws with hardware securing the terminal block bracket and thermostat assembly.
6. Disconnect thermostat control wire connectors from terminal block.
7. Remove thermostat assembly with capillary tubing and bulb from mounted position.
8. Install replacement thermostat assembly by reversing above steps:
   a. Thermostat adjustable dial must not bind on control chassis.
   b. Rotate capillary tube in same manner as original tubing. Install properly in clips.
   c. Mount thermostat bulb in bracket.
   d. Make sure trim/heater and hood/trim assemblies are properly seated.
9. Check thermostat operation — see Paragraph 2-5-1.

3-2-5 Replacement of Cryostat Heaters

3-2-5-1 The strip heaters are held to CRYOSTAT surfaces by RTV adhesive. When replacing a heater apply RTV adhesive, then install heater. For strip heaters, use duct tape or clamps to hold heater in place until adhesive is dried; approximately 12 hours.

3-2-5-2 Pan Heater Assembly Replacement (5-1-43):

Tools Required: Screwdriver
Heater blower

NOTE: The pan heater is located below the interior drain pan — see Figure 1-2. The connector leads for the pan heater enter the CRYOSTAT chamber at the point indicated in Figure 3-3.

1. Remove back cover assembly from instrument.
2. Remove the no drip tape from chamber opening (3-3-4).

NOTE: No drip tape may be softened by using hot blown air from a heater blower.

3. Cut necessary lead ties and remove pan heater wire lead connectors from terminal block — see Wiring Installation Diagrams at rear of this manual.

4. Peel pan heater from pan.
5. Replace pan heater per Paragraph 3-2-5-1.

3-2-5-3 Trim Heater Assembly Replacement:

NOTE: The trim heater assembly is located within the top trim (Hood & Trim Assembly) — see Figure 3-1.

1. Lift the Hood and Trim Assembly as described in Paragraph 3-2-1, Steps 1 through 3.
2. Cut necessary lead ties and remove trim heater lead connectors from terminal blocks — see Wiring Installation Diagrams at the rear of this manual.
3. Peel trim heater from top trim and work wire leads through grommet.
4. Replace trim heater per Paragraph 3-2-5-1.

3-2-5-4 Top Heater Assembly Replacement:

NOTE: The top heater assembly is located on the underside of the trim and heater assembly — see Figure 3-1.

1. Lift the Hood and Trim Assembly as described in Paragraph 3-2-1, Steps 1 through 3.
2. Disconnect door electrical lead connector and remove sliding door.
3. Cut the necessary wire lead ties and disconnect heater connectors — see Wiring Diagrams at rear of this manual. Wire #16 connects to insulated tab.
4. Remove the trim and heater assembly as described in Step 7, Paragraph 3-2-4-3.
5. Remove insulation and heater from trim panel.
6. Replace top heater per Paragraph 3-2-5-1. Use a weight to secure components until adhesive is dry.

NOTE: RTV adhesive is used to secure heater to trim panel and insulation to heater.

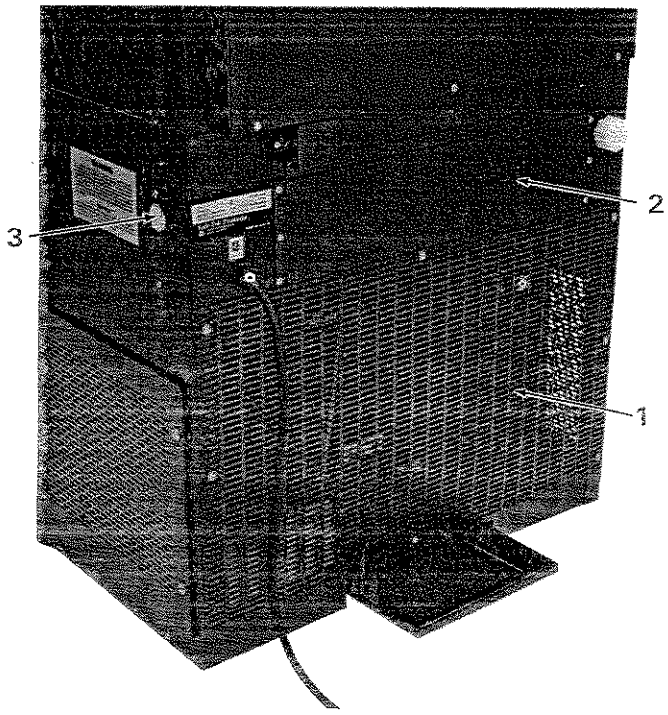


Figure 3-4
CRYOSTAT REAR

LEGEND

1. Compressor cover
2. Utility box
3. GFCI

LEGEND

1. GFCI
2. Utility box
3. Relay R1
4. Terminal block (10 terminals)
5. Isolation transformer
6. Ballast

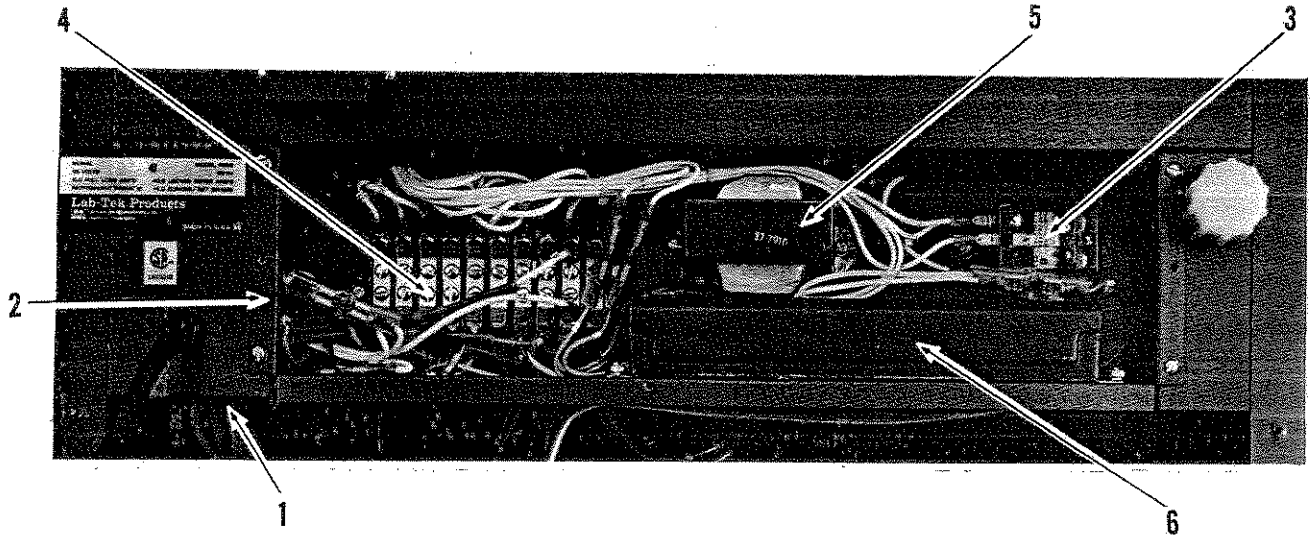


Figure 3-5
UTILITY BOX

3-2-5-5 Defrost Heater Replacement

NOTE: If defrost heater is inoperative, make sure OTP is not open. Follow procedure carefully as outlined to prevent errors or damage to instrument.

!WARNING!

The defrost heater is held in position by tabs on the evaporator assembly fins. The fins are sharp and can cause injury if caution is not used when working in this area.

Tools Required: Screwdriver — Large
Heater blower
Hammer — Small
Soldering iron & solder

1. Perform the following steps only, Paragraph 3-2-4-3, page 3.3: Steps 1, 4, 5, 6 and 7.
   a. Step 4 — Remove no drip tape at both heater lead locations.
   b. Step 7 — Carefully review CAUTION.
2. Remove Guard grille with thermostat bulb bracket from evaporator assembly. Remove thermostat bulb from bracket.
   NOTE: Guard grille may be snap-on or hardware secured version. Do not loosen the drain tray below evaporator assembly.
3. Remove defrost heater lead connectors from terminal block.
4. The defrost heater is secured to the evaporator fins by tabs. The old heater can be removed by tapping downward on it using a screwdriver (through evaporator assembly). Tap at several points until heater drops free. Remove heater by working free.
5. Install replacement heater by reversing above procedure.
   a. Work replacement heater up into mounted position. Secure heater by setting tabs from below evaporator, or by using securing wire.
   b. Run heater leads through chamber and replace no drip tape. Solder terminals to heater leads and connect leads to terminal block.
   c. Check complete Cryostat operation including top heater and trim heater.

3-2-6 Chamber OTP Replacement (Over Temperature Protector)

Tools Required: Screwdriver
Heater blower

CAUTION: If OTP is open, Defrost control may be defective.

1. WARNING: Turn the CRYOSTAT "off" and remove electrical line cord from AC outlet.
2. Remove back cover assembly from instrument.
3. Locate OTP wire leads:
   #10 at insulated tab.
   #10 at terminal block connector #9.
   Cut the necessary lead ties to remove OTP. Remove lead connectors.
4. Remove the no drip tape from chamber opening.
   NOTE: No drip tape may be softened by using hot blown air from a heater blower.
5. Remove the OTP assembly.
6. Install the replacement OTP by reversing the above procedure.
   a. Rotate the OTP wire leads in the same manner as original leads.
   b. Properly seal chamber opening with no drip tape.

3-2-7 Replacement of GFCI Receptacle (Ground Fault Circuit Interrupt)

NOTE: On earlier CRYOSTAT instruments, the GFCI was installed on the lower right side. The CRYOSTAT line cord plugged into this device with the GFCI line cord plugging into the AC outlet.

1. WARNING: Turn the CRYOSTAT "off" and remove electrical line cord from AC outlet.
2. Refer to Figure 3-4. Remove the compressor cover and utility box cover.
3. Refer to Figure 3-5. Remove the four screws securing the utility box. Lower utility box. Rest utility box on instrument base.
4. Remove two screws with hardware securing GFCI receptacle.
5. Note wire lead connections and replace GFCI receptacle.
6. Replace receptacle by reversing above steps.

3-2-8 Replacement of Relays

3-2-8-1 Two relays are installed in the CRYOSTAT. R1 is located in the utility box — see Figure 3-5. Relay R2 is located on the rear of the instrument base. On earlier manufactured instruments, R2 was installed on the bottom of the utility box. Both relays are readily accessible for replacement. For wire lead connections, refer to Wiring Installation Diagrams at the rear of this manual.

3-2-9 Replacement of Compressor

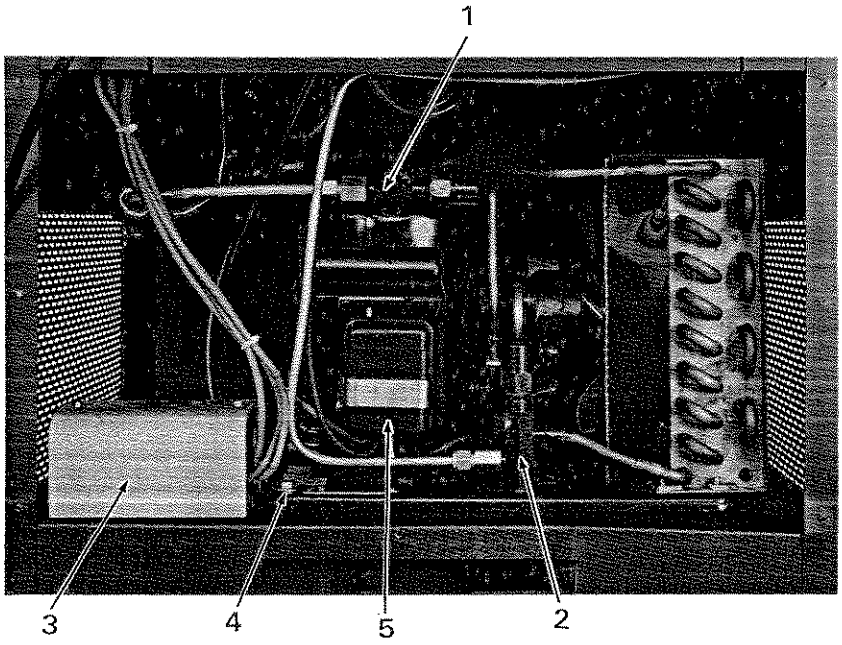
3-2-9-1 It is suggested that Cryostat refrigeration system servicing be performed by experienced refrigeration servicing personnel. Review Troubleshooting Section 4 and Paragraph 2-6 before replacing compressor.

Tools Required: Screwdriver
Valve wrench
Vacuum pump
14 oz. can of Freon "12"
Vacuum/pressure gauge

1. WARNING: Turn the CRYOSTAT "off" and remove electrical line cord from AC outlet.
2. Remove the compressor cover, the two ventilation grills and the utility box cover.

Refer to Figure 3-6 for following steps.

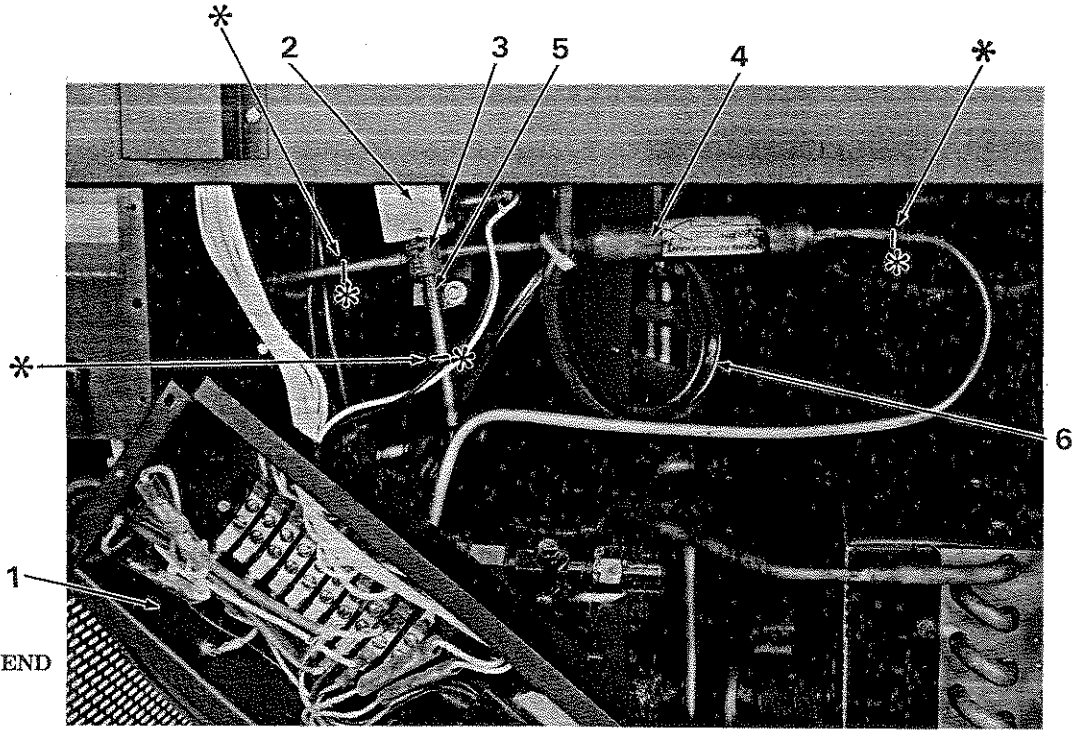
3. Remove the compressor charge. Remove the



LEGEND

1. Low pressure side valve
2. High pressure side valve
3. Relay R2
4. Compressor mounting screw
5. Compressor electrical box

Figure 3-6
COMPRESSOR MOUNTING



LEGEND

1. Utility box
2. Solenoid coil
3. Solenoid valve
4. Drier-filter
5. Valve holding clip
6. Drain pan tubing

* Points to cut

Figure 3-7
SOLENOID VALVE/COIL

low and high pressure side caps from the manifold and valve fittings. Using a valve tool, slowly open valves.

4. Using a wrench, remove both copper tubing/fittings from compressor.
5. Remove compressor wire lead connectors from:
   a. Terminal block terminal #7. Remove from utility box.
   b. Relay R2. Remove cover of R2. Remove from relay box.
   NOTE: See Wiring Installation Diagrams at rear of this manual.
6. Remove the three screws with hardware which secure the compressor to the CRYOSTAT base.
   NOTE: For additional compressor movability, relay R2 box may be loosened and moved.
7. Hold the electrical wire leads, drain hose and copper tubing out of the way and slide compressor out of CRYOSTAT.
8. Place the replacement compressor into the CRYOSTAT and position properly. Install and secure compressor hardware.
9. Connect both copper tubing/connectors to compressor fittings. Secure connectors. Check copper tubing for any contact against metal components. Isolate all tubing against contact vibration.
10. Install and connect the compressor wire lead removed in Step 5. Dress all leads correctly to avoid pinching.
11. Vacuum compressor to remove oil and charge system as described in Paragraph 2-6-2. Check system for leaks.
12. Install all covers.

3-2-10 Compressor Repair

(Refer to Figure 3-6)

3-2-10-1 Thermal Overload Protector:

NOTE: The compressor T.O.P. is located in the compressor electrical box. This protector should not be confused with the chamber OPT — see Paragraph 3-2-6.

1. Remove compressor electrical box cover by unsnapping metal clip.
2. Release T.O.P. securing spring.
3. To replace T.O.P. remove connecting wire leads and install on new component. Install T.O.P. and replace cover.

3-2-10-2 Compressor Start Relay:

NOTE: The start relay is located in the compressor electrical box.

1. Remove compressor electrical box cover by unsnapping metal clip.
2. Note relay wire lead connector locations. Using screwdriver, remove wire leads.
3. Grasp relay with pliers and pull from compressor connector.
4. To replace relay place on connector and install wire leads. Replace covers.

3-2-10-3 Compressor Start Capacitor:

1. Remove compressor electrical box cover by unsnapping metal clip.
2. Use a screwdriver and unsnap capacitor from mounted position.
   NOTE: Save capacitor plastic base.
3. Note two capacitor wire lead connections to start relay. Using screwdriver remove these wire leads.
4. Install replacement capacitor using plastic base. Correctly dress wire leads and connect to start relay.
5. Replace electrical box cover.

3-2-11 Replacement of Cryostat Solenoid Coil

3-2-11-1 The solenoid valve/coil is located in front of the utility box. The solenoid coil is mounted over the solenoid valve — see Figure 3-7.

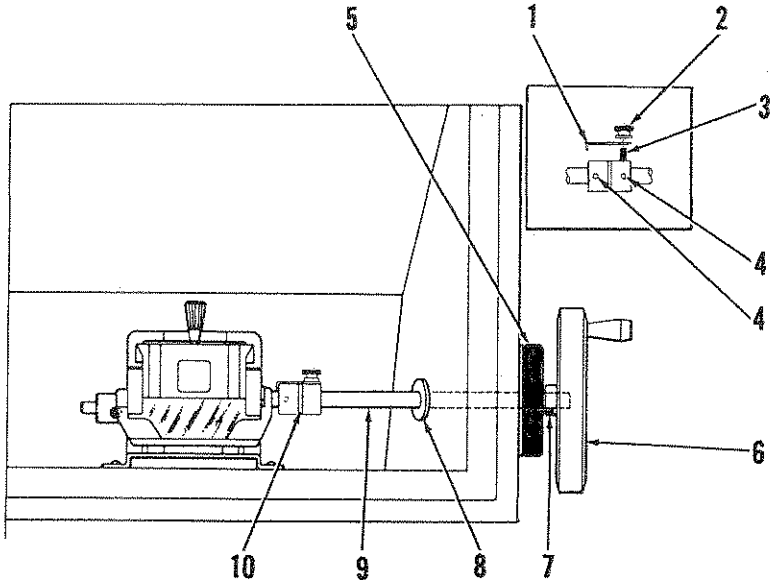
Tools Required: Screwdriver

1. WARNING: Turn the CRYOSTAT "off" and remove electrical line cord from AC outlet.
2. Remove the compressor cover and utility box cover.
3. Refer to Figure 3-5. Remove the four screws securing the utility box. Lower and rest utility box on instrument base.
4. Disconnect the two wire leads from solenoid coil terminals:
   Wire #36 Top
   Wire #32 Bottom
5. Remove the solenoid valve holding clip.
6. Remove the (10-32) nut from top of coil and remove coil from valve.
7. Replace coil by reversing the above steps.
8. Operate CRYOSTAT and check for correct solenoid valve operation.

3-2-12 Replacement of Solenoid Valve/Drier-Filter

3-2-12-1 A defective solenoid valve also indicates a defective filter-drier since moisture is the major reason valve failure. Both components should be replaced together. These components are located in front of the utility box — see Figure 3-7. The solenoid valve assembly or solenoid valve only may be replaced.

Tools Required: Screwdriver
Copper Tubing Cutter
Propane Torch or Equivalent
Solder and Flux
Vacuum Pump
14 oz. can of Freon "12"
Vacuum/pressure gauges
Valve tool
Asbestos paper



LEGEND

1. Retaining clip
2. Thumbnut
3. Long setscrew
4. Pin
5. Adjustable bearing
6. Handwheel
7. Handwheel setscrew
8. Grommet
9. Handwheel shaft
10. Split coupling

Figure 3-8
MICROTOME — HANDWHEEL COUPLING

LEGEND

1. Microtome mounting plate
2. Handwheel shaft
3. Keyhole slots for mounting Microtome
4. Split coupling (Handwheel shaft)

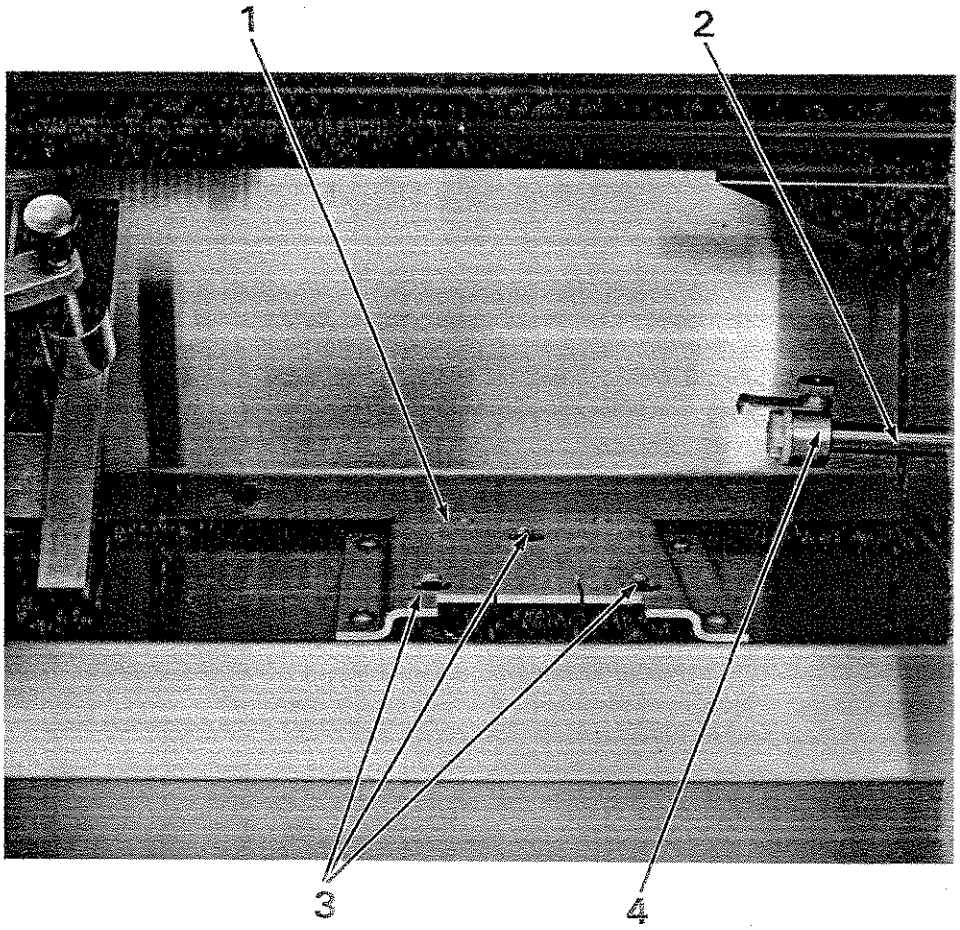


Figure 3-9
CRYOSTAT REFRIGERATION CHAMBER (MICROTOME REMOVED)

1. Perform Steps 1 through 3 of Paragraph 3-2-9. (Do not remove the two ventilation grills.)
2. Perform Steps 3 through 5 of Paragraph 3-2-11. Perform Step 6 if valve only is to be replaced.
3. Remove drain pan tubing tie and move drain tubing away. This tubing has a loop to form a trap and may contain water.

!WARNING!

The insulation foam used in the Cryostat is flammable. In the following steps make sure no foam is exposed where a propane torch is used. Use asbestos paper in any area where an open flame may contact foam.

4. Refer to Figure 3-7. Using a copper tube cutting tool, cut the copper tubing at the 3 points indicated:
   Point *a - cutting solenoid valve tubing at this point will leave the small (.083) capillary tubing untouched.
   *b - same as for point *a.
   *c - cutting tubing at this point allows solenoid valve and drier removal.
5. Unsolder tubing of old valve from capillary tubing.
6. Install replacement solenoid valve and filter-drier as follows:
   a. Solder valve to filter-drier.
   b. Mount solenoid valve with holding clip.
   c. Solder the 3 capillary tubes to the valve and filter-drier.
7. Install solenoid coil (if applicable), wire lead connectors, drain tube (with trap) and utility box.
   NOTE: Make sure coil securing nut is tight.
8. Vacuum compressor and charge system as described in Paragraph 2-6-2. Check system for leaks.
9. Install all covers.

3-2-13 Cryobar® Replacement

3-2-13-1 The Cryobar is mounted to the Cryostat cold bar by two socket head screws — see Figure 5-1.

Tool Required: Allen Wrench

1. Remove Microtome from Cryostat as described in Paragraph 3-3-1.
2. Remove the 2 Cryobar securing socket head screws. Screws are located on underside of cold bar. Remove old Cryobar.
3. Place thermo compound on replacement Cryobar.
4. Install replacement Cryobar.

3-3 MICROTOME REPAIR

3-3-1 Microtome Removal

3-3-1-1 The Microtome **should only be removed from a cooled Cryostat** under the following conditions:

a. Microtome cleaning and lubrication.
b. Microtome maintenance and adjustment.
c. Shipping Microtome for maintenance.
d. Shipping Cryostat and Microtome.
e. Shipping Cryostat.

If a cooled Microtome is removed, it will collect condensation. Installing a Microtome covered by condensation in a Cryostat could result in damage due to minute ice formation on moving parts — see CAUTION, Paragraph 3-3-2.

NOTE: A Microtome can temporarily be removed from a cool Cryostat by placing it in an adequate size plastic bag before removal. Force air out of bag and secure air tight. If condensation still forms, Microtome should be cleaned — see Paragraph 2-8-4.

!WARNING!

If Microtome/Cryostat contamination is suspected, see Paragraph 2-4-1.

1. Remove the knife blade from the Microtome — Refer to Figure 3-10:
   a. Loosen the two knife blade holding screws.
   b. Slide the blade to the left through the slots in the blade holder and remove.
2. Disengage Microtome shaft and handwheel assembly — see Figure 3-8:
   a. Remove the thumbnut securing the retaining clip from the long set screw on the extension shaft coupler. Remove retaining clip.
   b. Pull the handwheel shaft away separating the split coupling.
3. Remove the Microtome from the Cryostat:
   a. Pull Microtome forward sharply to unlock from base plate keyhole slots.
   b. Lift Microtome from base plate and remove from Cryostat.
   c. Set Microtome on a firm surface and allow to come to room temperature.

3-3-2 Microtome Replacement

CAUTION: Do not install a Microtome in the Cryostat which is covered with condensation including moving parts. Such a Microtome should be thoroughly dried including all moving parts. Minute ice formation on moving parts could result in Microtome damage.

LEGEND

1. Blade holding screws
2. Blade elevating screws
3. Knife blade holder
4. Knife blade

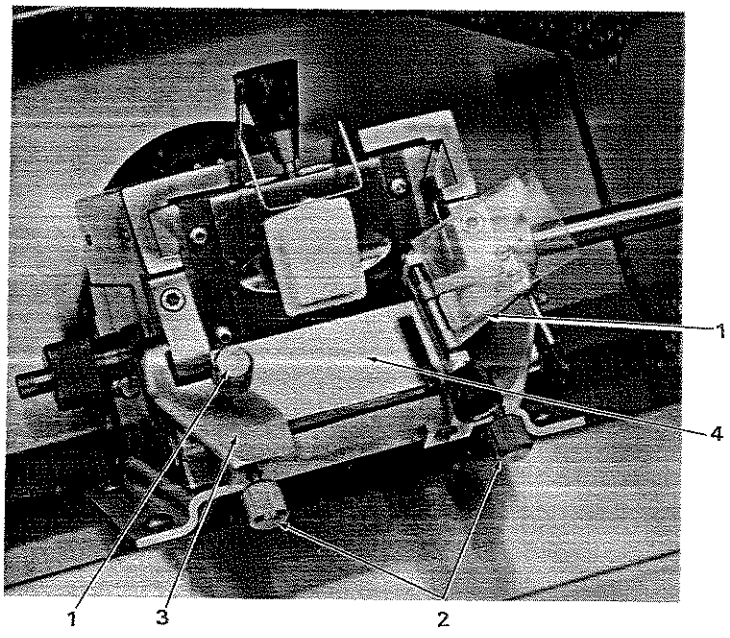


Figure 3-10
KNIFE BLADE INSTALLATION

LEGEND

1. Top slider assembly
2. Chuck knob
3. Chuck
4. Gear shield
5. Increment disengaging knob

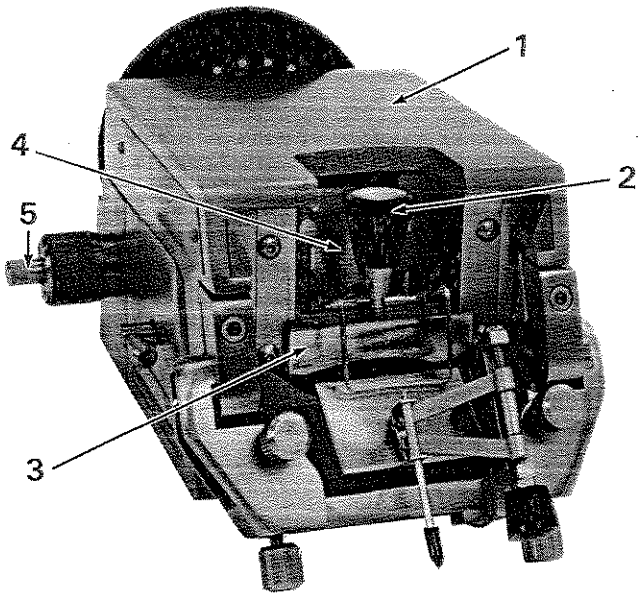


Figure 3-11
MICROTOME COMPONENTS

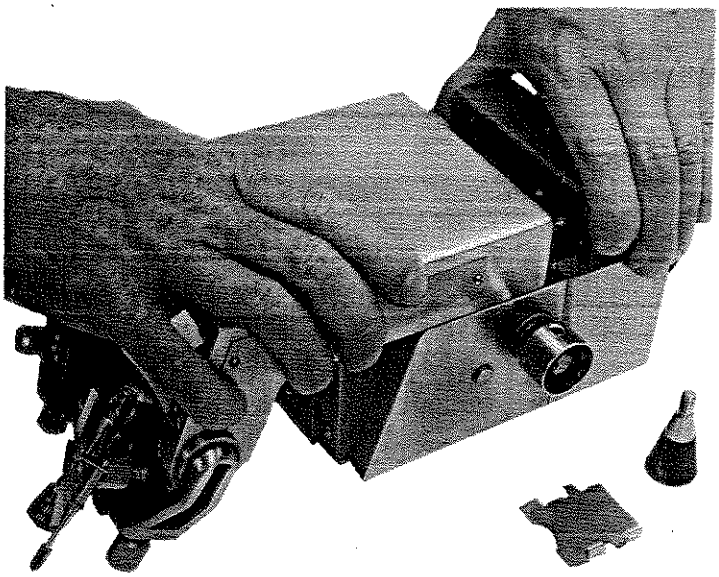


Figure 3-12
TOP SLIDER ASSEMBLY REMOVAL

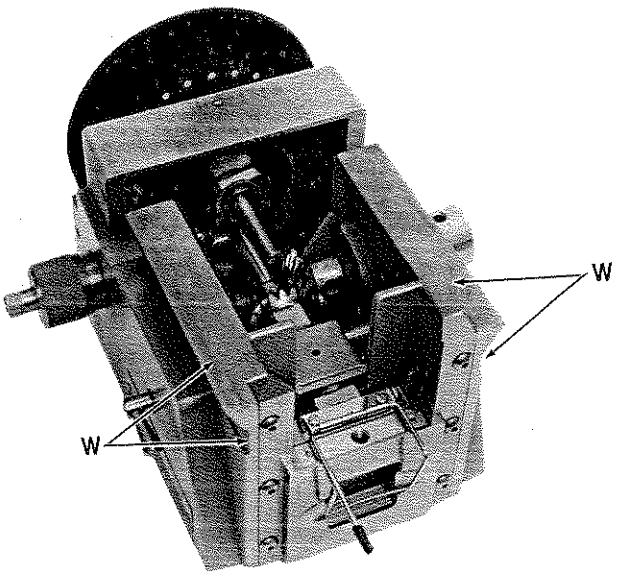


Figure 3-13
MICROTOME WITH TOP SLIDER REMOVED

1. Refer to Figure 3-9. Place Microtome on Cryostat mounting plate. Insert Microtome locking pin bushings into the plate keyhole slots. Push the Microtome back until it locks.
   NOTE: If Microtome is loose on base plate, check tension of base plate tab and be sure flanged bushings are screwed tightly.
   a. Center section (slotted area) of base plate is bent upward slightly to secure Microtome in place. With the Microtome in position, the tab in base plate should provide enough tension to hold the Microtome firmly in place.
   b. Adjust tab as necessary with pliers. Do not pry with screwdriver as tank can be punctured.
2. Align the Microtome split coupling (white reference line) to the handwheel split coupling (black reference line) and insert the two couplings together.
3. Refer to Figure 3-8. Place the retaining clip over the split coupling and install thumbnut. Secure thumbnut finger tight.
4. Check handwheel shaft for proper alignment.
   a. Turn the handwheel through several revolutions; it should move freely and easily through each revolution. If not, handwheel adjustment may be required — go to Step 4b.
   NOTE: The most common cause of difficult handwheel operation is failure to push the Microtome back correctly on the mounting plate (Step 1).
   b. Refer to Figure 3-8. Loosen the adjustable bearing on the outside of cabinet. Adjust bearing up and down until handwheel shaft, split coupling and Microtome coupling are in line. Tighten the adjustable bearing. Repeat Step 4a above.
5. Place the knife blade in the Microtome — Refer to Figure 3-10.
   a. Loosen the blade holding screws.
   b. Slide the knife blade from the left side through the slots in the blade holder until the blade is approximately centered between the outer edges of the holder. The blade may be shifted either right or left of center. Movement of the blade allows more uniform wear on the cutting edge and maximizes blade life.
   c. The position of the cutting edge can be raised or lowered by adjusting the blade elevating screws.
   d. Tighten the blade holding screws until the blade is firmly secured in the blade holder.
6. To adjust knife blade, see Paragraph 2-8-1.

3-3-3 Top Slider Assembly Removal

3-3-3-1 The Top Slider Assembly may be removed with the Microtome in the Cryostat. If Microtome is cool, use precautionary measures for working with cold steel. Refer to Figure 3-11.

1. Unscrew and remove chuck knob.
2. Place the Microtome chuck at its bottom position and place anti-roll devices out of the way.
3. Remove gear shield. Using screwdriver, pry shield forward.
4. Depress increment disengaging knob and turn 90° either direction until it remains depressed.

Refer to Figure 3-12 for the following steps.

5. As viewed from Microtome rear, rotate the gross adjusting wheel counterclockwise until top slider has reached its forward-most movement and wheel turns freely.
6. Grasp top slider and slide forward off of lower housing assembly.
7. Top Slider Assembly Replacement — refer to Figure 3-13.
   a. Depress Microtome surfaces indicated "W."
   b. Line top slider up with Microtome and carefully push slider onto Microtome. Push top slider until the lead nut (5-4-21) contacts the lead screw (5-4-52).

CAUTION: Threads of lead screw are fine and may be stripped easily. Do not damage threads of lead screws.

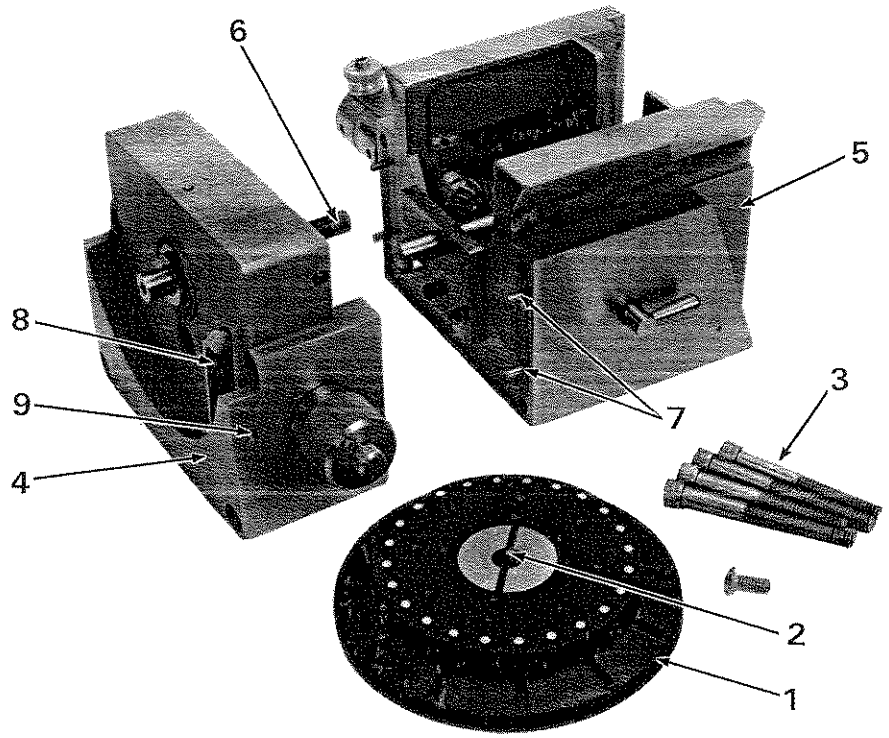
NOTE: Check to see that bail type anti-roll device is not below Microtome knife holder as damage to the device may occur when positioning top slider in next step.

   c. As viewed from Microtome rear, rotate the gross adjustment feed wheel clockwise to move top slider into desired positions.
   d. Install gear shield making sure it is secured.
   e. Install chuck knob.

3-3-4 Back Housing Assembly Removal

Tools Required: Phillips Screwdriver
Allen Wrench

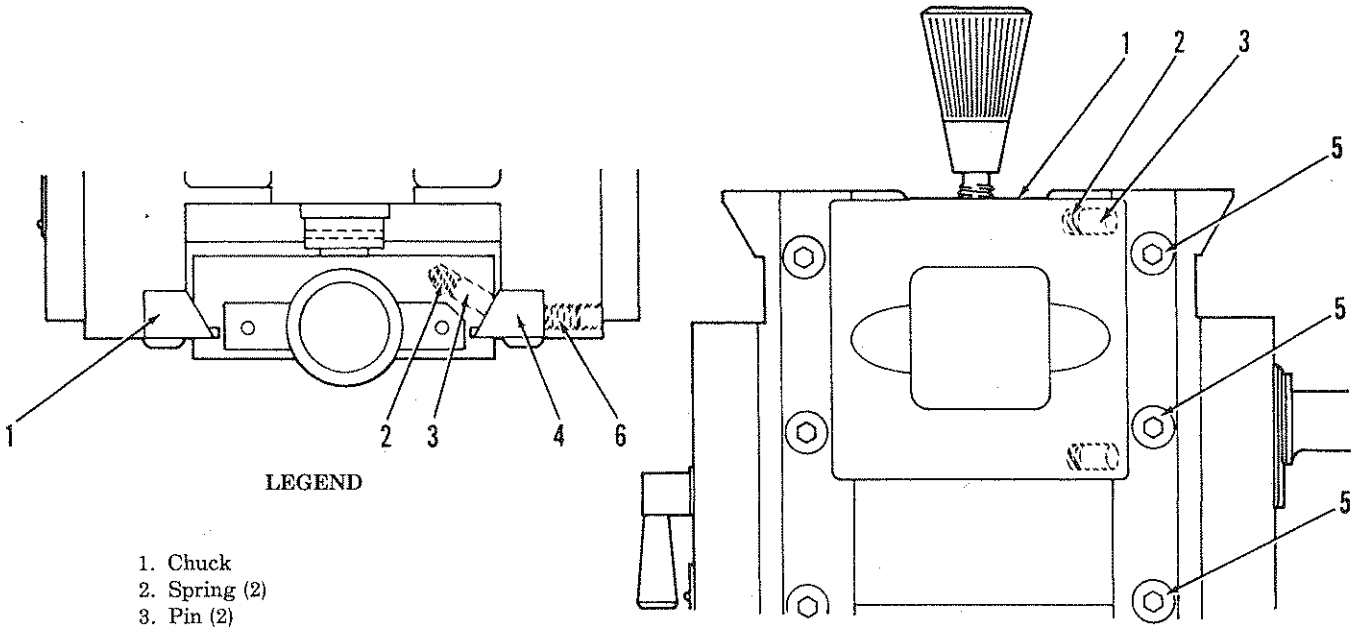
1. Remove Top Slider Assembly as described in Paragraph 3-3-3.
2. Remove gross adjustment feed wheel by removing securing screw.
   NOTE: Lead screw key may come off with wheel.
3. Remove the four socket head screws securing back housing to gear housing.
4. Refer to Figure 3-14. Remove back housing from gear housing. Very carefully pry back housing loose. Aligning pins may be tight.
5. Back housing replacement:
   a. Work back housing onto gear housing evenly.
   b. Secure with short socket head screws (top) and long socket head screws (bottom).



LEGEND

1. Gross adjustment feed wheel
2. Key — lead screw
3. Socket head screws (2 each)
4. Back housing
5. Gear housing
6. Lead screw
7. Aligning pins
8. Drag spring
9. Drag spring adjusting screw

Figure 3-14
REMOVING BACK HOUSING



LEGEND

1. Chuck
2. Spring (2)
3. Pin (2)
4. Vertical gib (2)
5. Gib securing screw
6. Set screw — gib adjusting

Figure 3-15
COMPENSATING CHUCK/VERTICAL GIBS

3-3-5 Removal of Chuck/Vertical Gibs

3-3-5-1 Refer to Figure 3-15. The compensating chuck employs two spring load pins which operate against the right vertical gib.

Tools Required: Screwdriver
Allen wrench

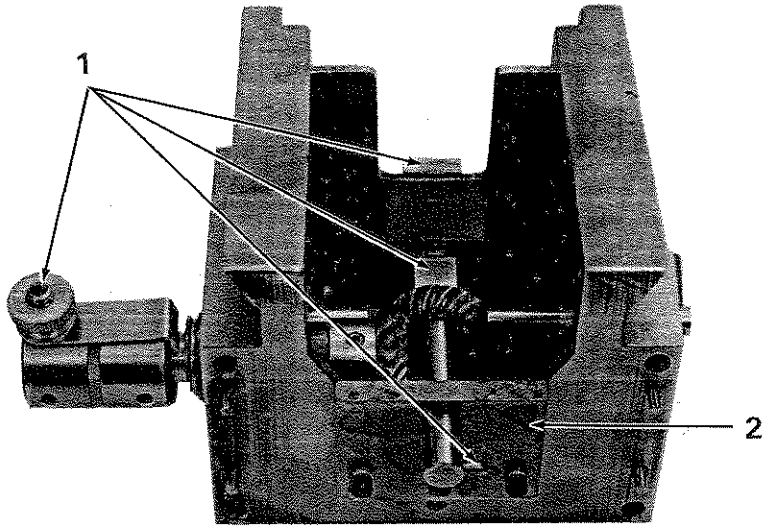
1. Remove top slider assembly as described in Paragraph 3-3-3.
2. If desired, remove bail type anti-roll device from chuck.
3. Set chuck at the center point of its vertical travel.
4. Loosen the 3 vertical gib adjusting set screws.
5. Using care, remove the 3 socket screws securing the right vertical gib. Hold vertical gib in place after screws are removed.
6. Carefully pivot chuck with gib out of Microtome. Hold gib against chuck to prevent pin and spring from flying out. Carefully release spring pressure to prevent this.
7. Chuck replacement:
   a. Set chuck cam arm roller at top point of chuck vertical travel.
   b. Install lower spring and pin in chuck. Set gib properly in place over pin. Hold gib in place and slide down to expose upper chuck spring/pin hole. Install upper spring and pin in chuck. Slide gib up over top pin.
   c. Holding gib against chuck, set chuck in place on Microtome. Install 3 gib securing screws and secure.
   d. Lubricate chuck with "A" oil as described in Paragraph 2-8-3.
   e. Adjust the right vertical gib as described in Paragraph 2-8-5.
   f. When chuck adjustment is complete, install anti-roll device and top slider assembly as described in Paragraph 3-3-3, Step 7.

3-3-6 Gear Housing Assembly Drive Repair

3-3-6-1 Bearings, gears and other components of the gear housing assembly may be field replaced with the exception of components indicated * in the parts list for Figure 5-4. These components are not drilled for dowel pins. The gears are secured with dowel pins and set screws. Gear components must maintain reference positions indicated in Figure 3-16. This reference allows chuck to be at top of its travel when the chuck lock shaft is set. Gears must mesh properly with no binding, end play or shaft/bearing play. Some units require shims installed on gear shafts to remove play. Disassemble Microtome as described in the paragraphs of this section.

3-3-7 Back Housing Assembly Repair

3-3-7-1 Components of the back housing are serviceable with the exception of the components indicated * in the parts list for Figure 5-4. Maintenance of the increment adjustment assembly is given in Paragraph 2-8-4-1, Step 7.



LEGEND
1. Reference points
2. Rear bearing block (Later instruments)

Figure 3-16
GEAR HOUSING REFERENCE POINTS

3-4 CRYOSTAT SHIPPING

3-4-1 Figure 3-17 illustrates the Cryostat shipper assembly. Remove the following when shipping Cryostat for service:

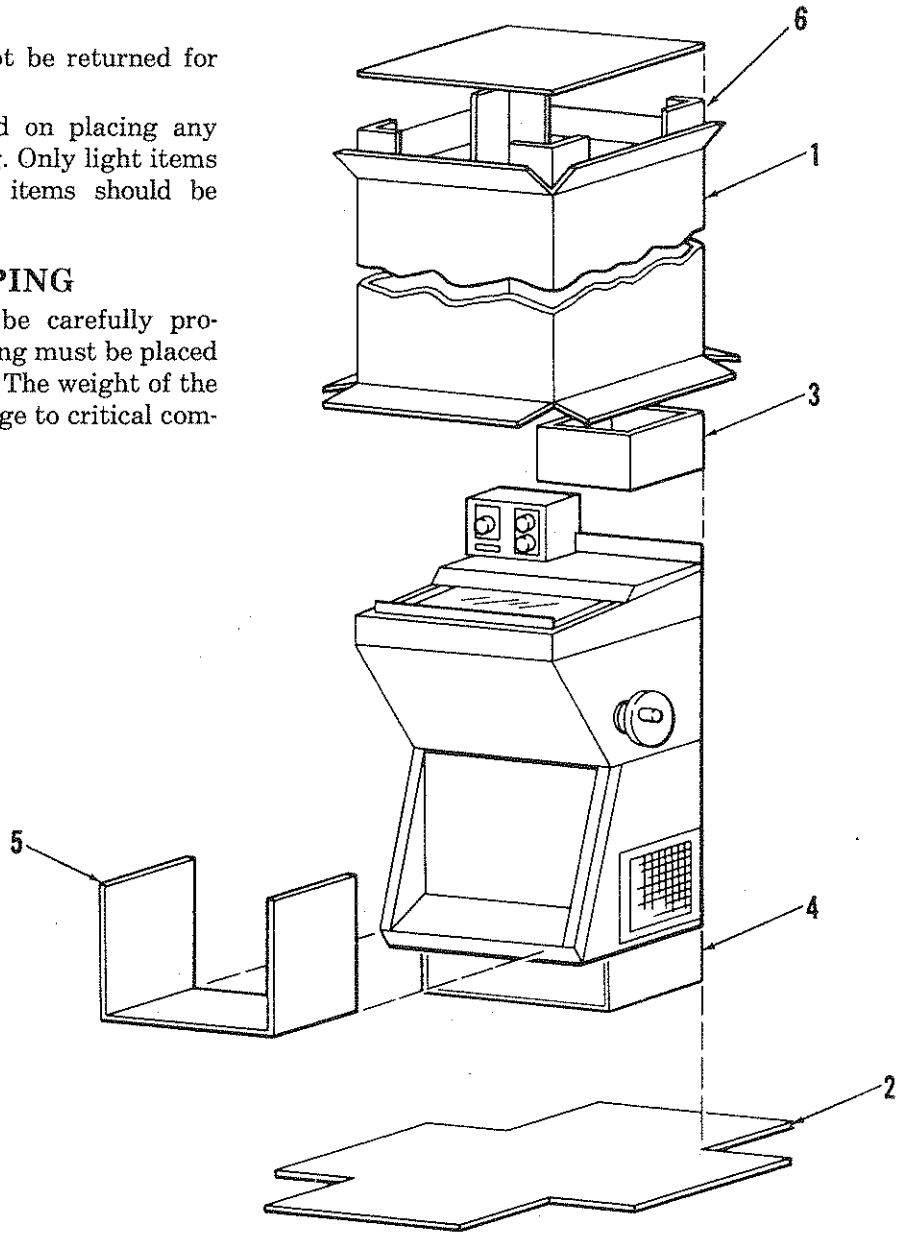
1. Microtome
2. Handwheel and shaft
3. Utility tray
4. Debris tray
5. Rubber mat
6. All loose objects

NOTE: The above items need not be returned for service.

Extreme caution should be used on placing any items in the chamber for shipping. Only light items should be packed there. Heavy items should be shipped under separate cover.

3-5 MICROTOME SHIPPING

3-5-1 The Microtome must be carefully protected for shipment. Proper packing must be placed around Microtome for protection. The weight of the Microtome can easily cause damage to critical components during shipment.



LEGEND

1. Carton
2. Bottom piece
3. Spacer — Top
4. Spacer — Bottom
5. Spacer — U
6. Corner (4)

Figure 3-17
CRYOSTAT SHIPPER

SECTION 4 TROUBLESHOOTING

4-1 INSTRUCTIONS

4-1-1 This section contains instructions on troubleshooting the Cryostat and Microtome. The tables contain a listing of common failures along with probable causes and corrective actions. Paragraph numbers refer to maintenance, repair or other informational assistance contained in this manual.

TABLE 4-1
CRYOSTAT TROUBLESHOOTING

SYMPTOM	PROBABLE CAUSE	CORRECTIVE ACTION
A. Cryostat will not operate (Line cord plugged in)	1. AC power at wall outlet.	1. Check AC outlet.
	2. GFCI tripper.	2. Reset GFCI — Paragraph 2-2.
	3. OFF-ON Switch or electrical wire, connector, etc...	3. Check Switch, wire connector, etc...
B. Compressor does not operate—		
• heaters all on, chamber temperature high.	1. Defrost control timer stuck in defrost mode.	1. Check control timer; Replace defective unit — Paragraph 2-5-2.
• pan heater on.	1. Chamber OTP open. Defrost control timer stuck in defrost mode.	1. Check OTP, control timer. Replace defective components.
	2. Defrost control timer switch not in compressor mode.	2. Check relays R1 & R2, control timer; Replace if defective — Paragraph 2-5-2.
• all electrical components normal.	1. Relay R2.	1. Check relay R2.
	2. Compressor TOP, start relay or capacitor.	2. Troubleshoot compressor components; Replace defective components — Paragraph 3-2-10.
C. Cryostat does not defrost.	1. Defrost control timer — • not sensing chamber temperature. • Switch defective	1. Check control timer; Replace defective unit — Paragraph 2-5-2.
	2. Chamber OTP open.	2. Check OTP; Replace defective unit — Paragraph 3-2-6.
	3. Defrost heater defective.	3. Check defrost heater — Paragraph 2-5-2. (Not field replaceable)

TABLE 4-1
CRYOSTAT TROUBLESHOOTING (Cont'd)

SYMPTOM	PROBABLE CAUSE	CORRECTIVE ACTION
D. Duration of defrost cycle too short to melt frost.	1. Defrost control timer thermostat defective. (+5°C normal)	1. Replace control timer — Paragraph 3-2-4-3.
E. Duration of defrost cycle excessive.	1. Defrost control timer thermostat defective. (+5°C normal)	1. Replace control timer — Paragraph 3-2-4-3.
	2. Relay R1 contact	2. Check relay R1; Replace defective unit.
F. Cryobar cools normally, but chamber not cooling.	1. Thermostat out of adjustment, or defective.	1. Check thermostat — Paragraph 2—5. Replace if defective — Paragraph 3-2-4-4.
	2. Pan heater on continuously — • Thermostat switch • Relay R1 • Pan heater shorted	2. Check pan heater — Paragraph 1-4-4-1. • Troubleshoot — Replace defective components.
	3. Solenoid valve coil defective.	3. Check solenoid coil. Replace if defective — Paragraph 3-2-11.
	4. Solenoid valve/dryer defective.	4. Check compressor charge — Paragraph 2-6-2. Replace valve/dryer — Paragraph 3-2-12.
G. Compressor operates normally, but poor chamber cooling.	1. Compressor condenser coils blocked with lint-dust.	1. Vacuum condenser coils.
	2. Pan heater shorted heating chamber excessively.	2. Check pan heater for excessive heating. Replace pan heater — Paragraph 3-2-5-2.
	3. Compressor charge	3. Check compressor charge — Paragraph 2-6-1.
	4. Refrigeration system leak.	4. Check refrigeration system — Paragraph 2-6-3.
H. Trim heater not working.	1. Trim heater or top heater defective.	1. Troubleshoot heater circuits — See Paragraph 2-7. Replace defective components — Paragraph 3-2-5.

TABLE 4-1
CRYOSTAT TROUBLESHOOTING (Cont'd)

SYMPTOM	PROBABLE CAUSE	CORRECTIVE ACTION
I. Chamber fluorescent lamp does not illuminate. NOTE — See Symptom J.	1. Fluorescent lamp defective 2. Lamp circuit component: • lamp holder • wire lead • ballast • door switch • isolation transformer	1. Replace lamp — Paragraph 3-2-1. 2. Troubleshoot lamp circuit. Replace defective component.
J. Condensation on sliding door window. NOTE — See Symptom I.	1. Window heater defective 2. Door heater connector 3. Window heater circuit component: • wire lead • door switch • isolation transformer	1. Replace sliding door — Paragraph 3-2-2. 2. Check door heater connector. 3. Troubleshoot door heater circuit. Replace defective component.

TABLE 4-2
MICROTOME TROUBLESHOOTING

SYMPTOM	PROBABLE CAUSE	CORRECTIVE ACTION
NOTE: A few drops of Microtome oil on areas suspected of having ice formation will normally relieve the condition.		
A. Thick-thin sections and/or skipping.	1. Ratchet assembly not engaging every time — number of clicks as handwheel is turned not corresponding with setting on increment adjustment. (One click, 2μm, for each setting of increment adjustment knob.)	1. Ice or foreign matter on pawl arm, pawl, or spring. Clean as required, and lubricate — See Paragraph 2-8-4.
	2. Knife blade loose.	2. Secure & adjust knife.
	3. Object holder loose in chuck.	3. Secure object holder.
	4. Drag spring.	4. Check and adjust drag spring — Paragraph 2-8-8.
	5. Vertical gibs out of adjustment.	5. Check and adjust vertical gibs — Paragraph 2-8-5.
	6. Horizontal gibs out of adjustment.	6. Check and adjust horizontal gibs — Paragraph 2-8-6.
	7. Buffer pin or springs defective or require lubrication.	7. Clean and lubricate as described in Paragraph 2-8-4.
	8. Lead screw nut retaining clips defective.	8. Replace defective components.
B. Handwheel turns easily, chuck moves properly, knife blade will not advance.	1. Increment disengaging knob not released.	1. Release knob.
	2. Increment disengaging knob will not release, frozen.	2. Clean and lubricate increment knob assembly — Paragraph 2-8-4, Step 7.
	3. Ice or foreign matter on pawl, pawl spring, pawl arm spring, or teeth of ratchet wheel.	3. Clean and lubricate Microtome — Paragraph 2-8-4.
	4. Defective pawl spring or ratchet wheel & pawl arm assembly.	4. Check and replace defective parts — See Paragraph 3-3-7.
	5. Lead screw nut or retaining clips defective.	5. Check and replace defective parts — See Paragraph 3-3-7.

TABLE 4-2
MICROTOME TROUBLESHOOTING (Cont'd)

SYMPTOM	PROBABLE CAUSE	CORRECTIVE ACTION
C. Handwheel turns easily: • Chuck does not move • Chuck moves erratic	1. Dowel pin securing gear(s) sheared.	1. Check gears, dowel pins — See Paragraph 3-3-6.
D. Handwheel difficult to turn. Gross adjustment wheel turns easily.	1. Ice or foreign matter on bearing surfaces, gear teeth, crank arm or roller, or between chuck and vertical gibs.	1. Clean and lubricate Microtome — Paragraph 2-8-4.
E. Handwheel difficult to turn. Gross adjustment wheel difficult to turn.	1. Ice or foreign matter in back of horizontal gibs or on threads of lead screw or lead screw nut.	1. Clean and lubricate Microtome — Paragraph 2-8-4.
F. Handwheel turns backward but not forward.	1. Ice or foreign matter on internal parts.	1. Clean and lubricate Microtome — Paragraph 2-8-4.
G. Thumping or scraping noise when handwheel turned.	1. Ice or foreign matter on internal parts.	1. Clean and lubricate Microtome — Paragraph 2-8-4.
H. Object holder will not fit in chuck.	1. Ice on chuck jaws, riser, springs or screws. 2. Chuck screws not properly adjusted.	1. Clean and lubricate Microtome — Paragraph 2-8-4. 2. Adjust chuck jaws — Paragraph 2-8-7.
I. Chuck hit top slider at top of its travel.	1. Chuck screws not properly adjusted.	1. Adjust chuck jaws — Paragraph 2-8-7.
J. Entire Microtome loose on mounting plate.	1. Mounting tab not adjusted properly. 2. Locking bushings on Microtome bottom loose.	1. Check & adjust tab — Paragraph 3-3-2. 2. Secure bushings.

SECTION 5 ILLUSTRATED PARTS BREAKDOWN

5–1 REPLACEMENT PARTS

5–1–1 This section contains parts replacement information on the Tissue-Tek II Microtome/Cryostat. All parts are listed by assembly and index number. Parts indicated with a dagger (†) are parts most used and recommended for stocking. Parts indicated * are not available for field replacement.

INDEX

FIGURE	SUBJECT	PAGE
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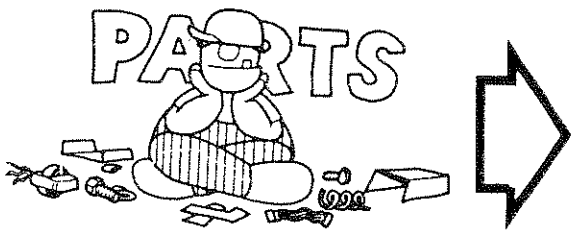
5-2	Cryostat Hood & Trim Assembly—Exploded View	5.4
5-3	Cryostat Rear Case—Exploded View	5.6
5-4	Microtome Assembly—Exploded View	5.8



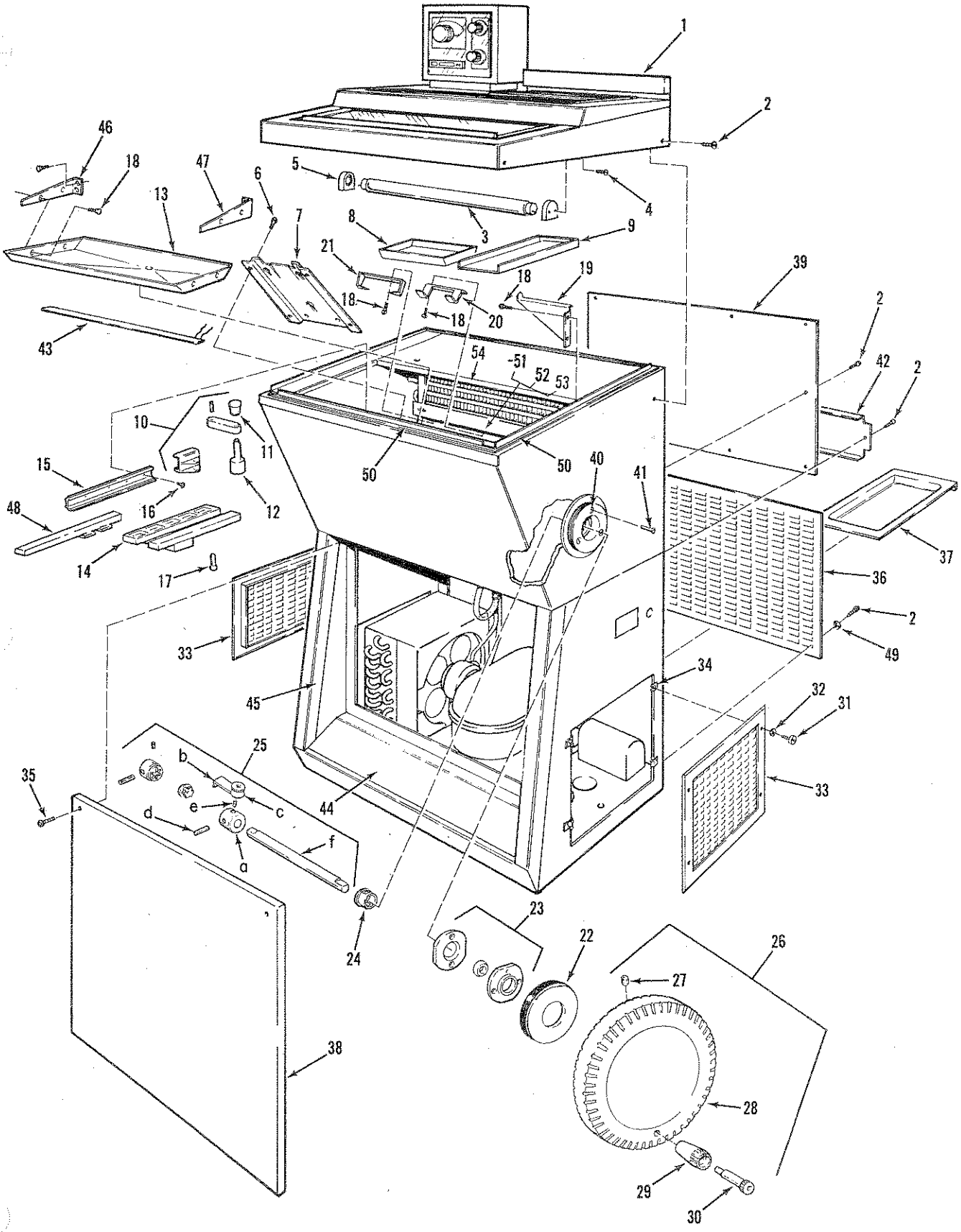


Figure 5-1
CRYOSTAT — GENERAL EXPLODED VIEW

CRYOSTAT—GENERAL EXPLODED VIEW

FIGURE & INDEX NO.	DESCRIPTION	PART NO.	NO. REQ'D.
5-1-1	Hood & Trim Assembly—See Figure 5-2	—	—
-2	Screw (6 x 3/8) Pan Hd.	54060601	35
-3	Bulb—Fluorescent	†40331033	1
-4	Screw (4-36 x 7/16) Rd. Hd.	51040712	4
-5	Lampholder	40210017	2
-6	Screw (1/4-20 x 1/2) Button Hd.	51250807	4
-7	Plate—Microtome Mounting	50455136	1
-8	Tray—Debris	50573010	1
-9	Tray—Utility	50540059	1
-10	Heat Extractor Assembly	†95000118	1
-11	Knob	50301003	1
-12	Heat Extractor	50210010	1
-13	Tray — Drain	50573011	1
-14	Embedding Bar (Cryobar®)	†50040014	1
	Thermo Compound	40068001	—
	Cover — Cryobar Frost	50062122	—
-15	Support Bar	50040013	1
-16	Screw (6-32 x 3/8) Pan Hd.	51060600	4
-17	Screw (10-32 x 5/8) Socket Head Cap	52101000	1
-18	Screw (6-32 x 1/4) Pan Hd.	51060400	16
-19	Bracket—Shelf	50032085	1
-20	Brush Holder	50214015	1
-21	Bracket—Bulb (Thermostat)	50032218	1
-22	Cap—Bearing Lock	50065014	1
-23	Bearing Unit (Nylon)	50044048	1
-24	Bushing—Snap	50041011	2
-25	Shaft & Coupling Assembly	—	—
a	Coupling Assembly (Two Pieces)	95000279	1
b	Retainer-Coupling	50079005	1
c	Retaining Nut	50330005	1
d	Roll Pin (5/32 x 1)	50460101	1
e	Set Screw (1/4-20 x 3/4)	53251201	1
f	Shaft—Handwheel	50552010	1
-26	Hand Wheel Assembly	95000128	1
-27	Set Screw (1/4-20 x 1¼)	53250404	1
-28	Hand Wheel	50660035	1
-29	Knob—Hand Wheel	50301014	1
-30	Bolt—Stripper (1/4-20 x 1¼)	50046003	1
-31	Screw—Special	50550015	8
-32	Washer—Retaining	50661028	8
-33	Grill—Ventilation	50180025	2
-34	Nut—Speed	50391040	8
-35	Screw (6 x 1) Pan Hd.	54061601	2
-36	Cover—Compressor	50062066	1
-37	Drip Pan	50450048	1
-38	Cover—Front	50062068	1
-39	Cover Assembly—Back	95000115	1
-40	Flange—Bearing Lock	50150008	1
-41	Screw (10-32 x 3/4) Flat Hd.	51101201	3
-42	Cover—Utility Box	50062067	1
-43	Pan Heater Assembly	†94000066	1
	Adhesive—RTV	50001037	1
-44	Pad—Foot	50151010	1
-45	Trim Assembly	95000127	1
-46	Bracket—Tray (LH)	50032238	1
-47	Bracket—Tray (RH)	50032239	1
-48	Freeze Bar (Quick Freeze)	50040010	—
-49	Flat Washer (#6)	50661003	8
-50	Rubber Insulation—Adhesive Backed	50241039	4
-51	Evaporator & Heater Assembly	95000110	1
-52	Heater — Defrost (390 Watts)	40211032	1
	Terminal — Connector	40062049	
-53	Guard & Clip Assembly (Field retrofit) (Not shown)	95000526	
-53	Grille — Protective (Mfg. Modification) (Not shown)	50180034	
	Washer (Nylon)	50661021	
	Screw—Self Tap (8 x 1/2)	54080810	
-54	Channel—Plastic Protector (Field retrofit)	50075008	
	SHIPPING ITEMS		
	Shipper—Cryostat	50453161	1
	Bag—Plastic	50453017	1
	Skid	50453087	1
	Export Overshipper	50453171	1
	RATING LABELS		
	Model 4553	50332067	1
	Model 4554	50332076	1
	Model 4558	50332192	1
	Model 4559	50332060	1

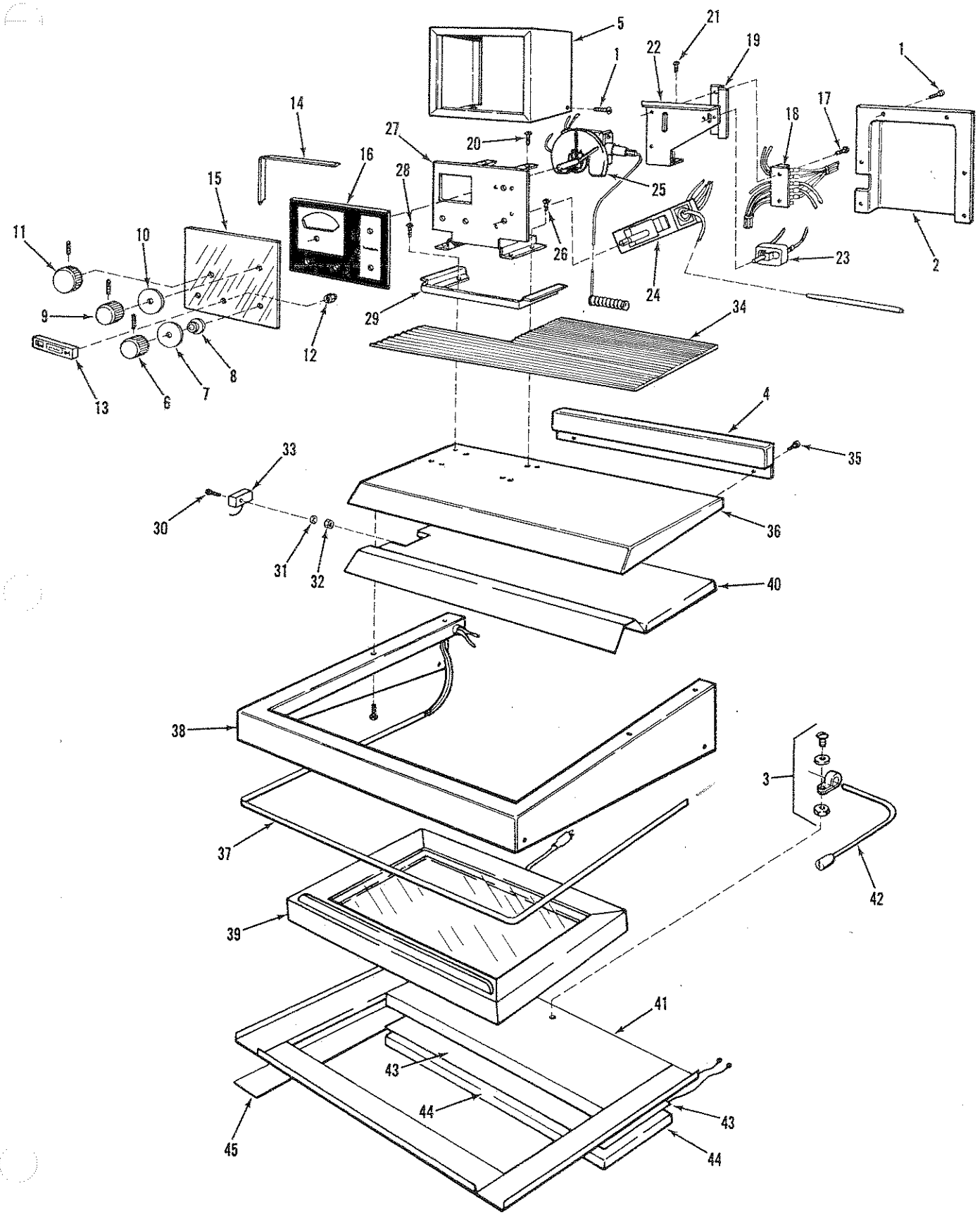


Figure 5-2
CRYOSTAT HOOD & TRIM ASSEMBLY — EXPLODED VIEW

CRYOSTAT HOOD & TRIM ASSEMBLY—EXPLODED VIEW

FIGURE & INDEX NO.	DESCRIPTION	PART NO.	NO. REQ'D.
5-2-1	Screw (6 x 3/8) Pan Hd.	54060601	6
-2	Cover—Control Box	50062064	1
-3	Cable Clip	50071005	1
	Screw—Clip (6-32 x 3/8)	51060608	1
	Washer (No. 6)	50661003	1
	Nut (6-32)	50391004	1
-4	Rail—Rear	50513014	1
-5	Housing—Control Box	50215031	1
-6	Knob—Defrost	50301015	1
-7	Bezel—Time of Day (Dial)	50030047	1
-8	Spacer—Timer Shaft	50541078	1
-9	Knob—ON/OFF Switch	50301019	1
-10	Bezel—ON/OFF Knob	50030048	1
	Tape—Bezel Mounting	50572025	1
-11	Knob—Temperature Control	50301020	1
-12	Fastener—Pushnut	50156002	2
-13	Name Plate	50393009	1
	Insert (CRYOSTAT)	50241016	1
	Insert (TISSUE-TEK II)	50241025	1
-14	Tape—Electrical (3/4" Wide)	50572006	AR
-15	Faceplate—Instrument (Transparent)	50150018	1
-16	Faceplate—Instrument (Control)	50215028	1
-17	Screw (6-32 x 3/16) Pan Hd.	54060806	2
-18	Terminal Block Assembly	94000076	1
-19	Bracket—Terminal Block	50032084	1
-20	Screw (6-32 x 1/4) Pan Hd.	51060400	2
-21	Screw (8-32 x 1/4) Pan Hd.	51080400	4
-22	Plate—Control Mounting	50455120	1
-23	Switch—Rotary (ON/OFF)	40541102	1
-24	Control—TIME OF DEFROST		
	Model 4553/4558 (60 Hz)	†40570026	1
	Model 4554/4559 (50 Hz)	40570027	1
	Resistor Assembly (220 VAC Instruments)	94000075	1
-25	Thermostat Assembly	40570025	1
-26	Screw (6-32 x 3/8) Pan Hd.	51060600	3
-27	Control Chassis	50061018	1
-28	Screw (6-32 x 3/8) Pan Hd.	51060600	5
	Nut (6-32)	50391004	7
	Lockwasher—Int. Tooth (No. 6)	50331014	9
-29	Support Housing—Control Box	50543150	1
-30	Screw (4-40 x 11/16) Pan Hd.	51041100	2
-31	Lockwasher—Int. Tooth (No. 6)	50331017	2
-32	Nut (4-40)	50391003	2
-33	Switch Assembly—Door	94000062	1 — 5.00
-34	Pad—Rubber	50456019	1
-35	Screw (6-32 x 3/8)	51060600	9
-36	Hood	50210026	1
-37	Trim Heater Assembly	†94000067	1
-38	Trim top	50570053	1
	RTV Adhesive/Sealant	50001045	—
	Snap Bushing	50041003	1
-39	Window Assembly—Sliding (Heated)	†95000108	1
-40	Light Pan Support Assembly		
	Insulation	50242046	1
	Snap Bushing	50041007	1
	Cable Clamp	50072012	1
-41	Trim & Heater Assembly	95000111	1
-42	Window Cord Assembly	94000090	1
-43	Top Heater Assembly	94000063	1
-44	Insulation—Ethafoam	50242045	1
	Adhesive—RTV	50001037	—
-45	Rubber Insulation—Adhesive Backed	50241039	4

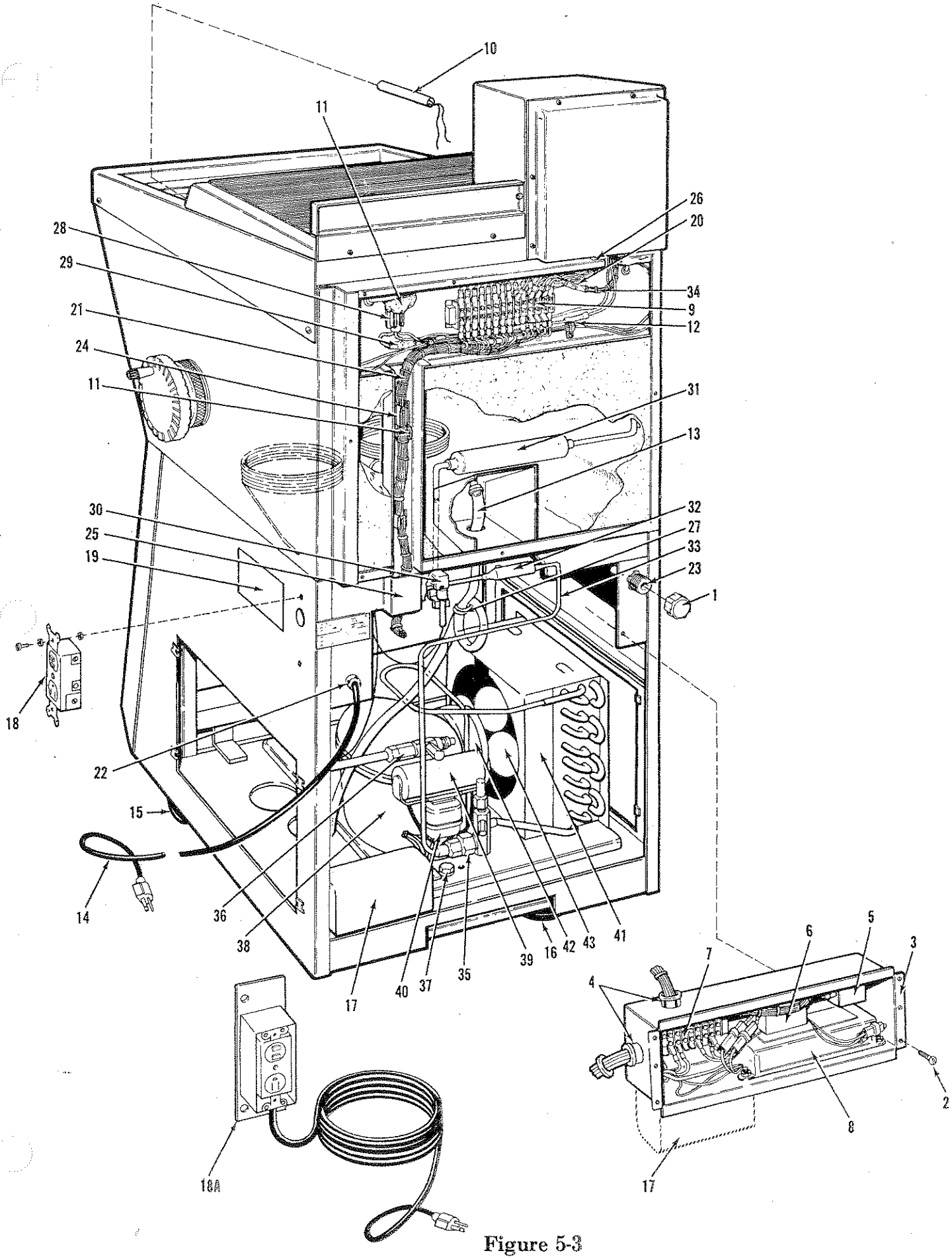
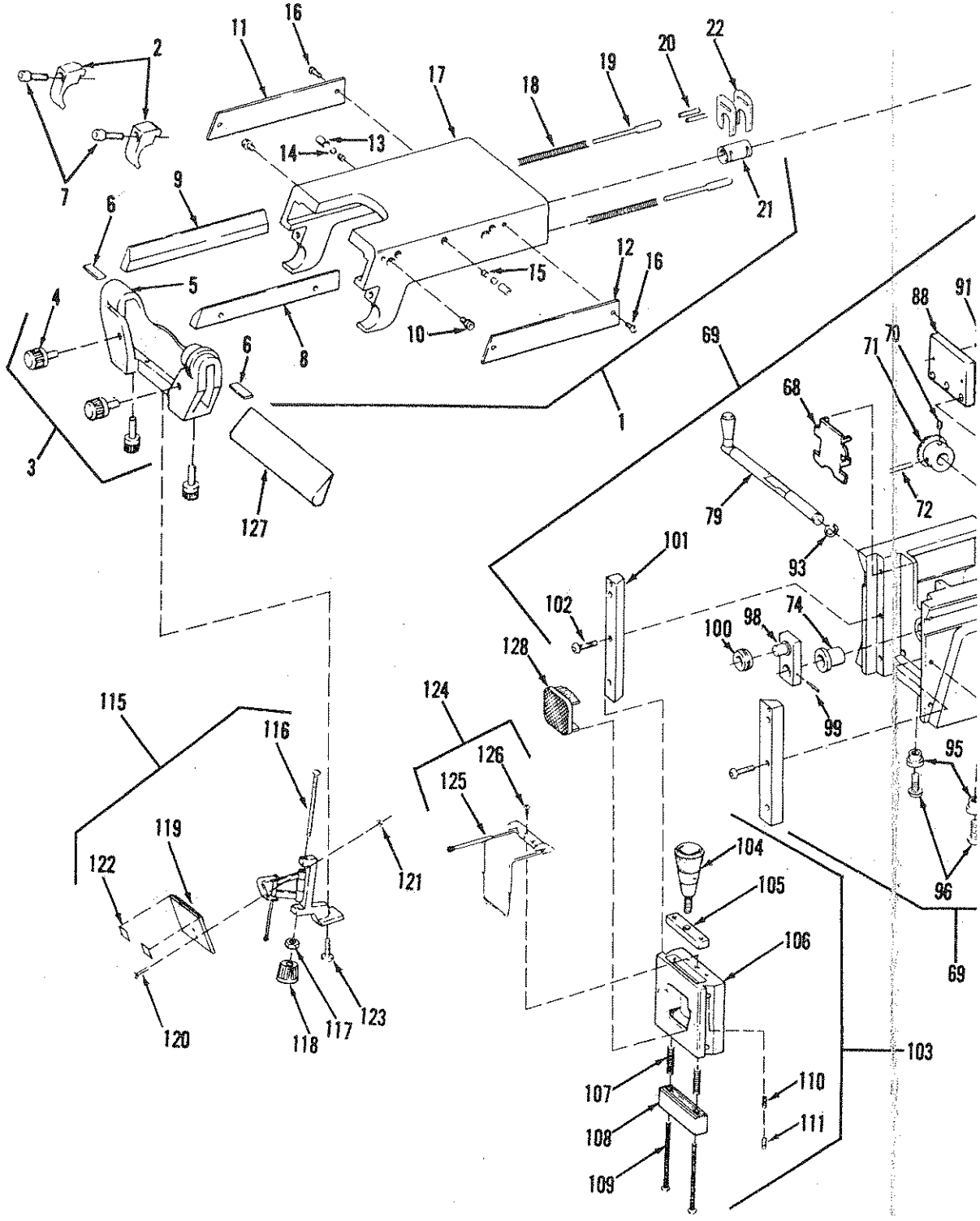


Figure 5-3
CRYOSTAT REAR CASE — EXPLODED VIEW

FIGURE & INDEX NO.	DESCRIPTION	PART NO.	NO. REQ'D.
5-3-1	Cap—Drain	50065021	1
-2	Screw (6-32 x 3/8) Truss Hd.	51060608	4
-3	Box—Utility	50036010	1
-4	Snap Bushing	50041011	2
-5	Relay (R1)	40511011	1
	Relay (R1) (Model 4559 only) (100 VAC/50 Hz)	40511031	1
	Screw (6-32 x 3/8)	—	2
	Nut (6-32)	—	2
	Lockwasher (No. 6)	—	2
-6	Isolation Transformer (115 VAC)	†94000078	1
	Screw (8-32 x 3/8)	—	2
	Nut (8-32)	—	2
	Lockwasher (No. 8)	—	2
-7	Terminal Block Assembly (10 Terminal)	94000077	1
	Marker Strip	40360004	1
	Screw (6-32 x 5/8) Pan Hd.	—	2
	Nut (6-32)	—	2
	Lockwasher (No. 6)	—	2
-8	Ballast Assembly	†94000061	1
	Screw (10-32 x 3/8) Bd. Hd.	—	2
	Split Washer (No. 10)	—	2
	Nut (10-32)	—	2
-9	Terminal Block Assembly	94000071	1
	Screw (6 x 1/2) Pan Hd.	54060801	2
	Tab (Flat)	40062073	14
	Tab (45°)	40062072	4
	Marker Strip (14 Way)	94360006	1
-10	Over Temperature Protector Assembly (OTP) (Microtemp Therm. Cutoff)	†94000064	1
-11	No Drip Tape	50572016	AR
-12	Clip—Cable	50071004	1
	Screw (6 x 3/8) Phillips	54060601	2
	Flatwasher (No. 6)	—	2
-13	Tubing—Drain Pan	50571048	2
-14	Line Cord Assembly	94000097	1
-15	Wheel—Front Swivel	50078001	2
-16	Wheel—Rear Rigid	50078002	2
-17	Relay (R2) (Relay Only)	†40511018	1
	Housing-Relay	50215011	1
	Screw (10-32 x 3/8) Bd. Hd.	51100600	3
	Washer—Split (No. 10)	50333004	3
	Nut—Hex (10-32)	50391006	3
	Wire Assembly (White)	94000306	1
	Wire Assembly (Red)	94000307	1
	Wire Assembly (Black)	94000308	1
	Wire Assembly (Blue)	94000309	1
	Wire Assembly (Black—11 inch)	94000310	1
	Bushing—Housing	50041002	1
-18	Receptacle—Ground Fault Circuit Interrupt	40510008 7	1
	Varistor (GE V130LA10A)	40630001	1
	Hole Plug	50457021	1
	Screw (6 x 1/2) Pan Hd.	54060801	2
	Nut (6-32)	50391004	2
	Lockwasher (No. 6) Int. Tooth	—	2

5-3
— EXPLODED VIEW

FIGURE & INDEX NO.	DESCRIPTION	PART NO.	NO. REQ'D.
-18A	External Ground Fault Interrupter Assembly (Modified instruments only — see -18)	—	1
-19	Warning Label—GFCI	50332228	—
-20	Cable Harness—Upper	94000065	1
-21	Cable Harness—Lower	94000096	1
-22	Grommet—Line Cord	40540008	1
-23	Fitting—Tank Drain	50155024	1
	Tubing—Tank Drain (½ I.D.)	50571049	1
	Nut—Fitting	50391041	1
-24	Cable Clamp	50072013	1
-25	Protective Cover	50062038	1
-26	Channel—Plastic	50075002	2
-27	Strap—Tie (Plastic)	50558005	3
-28	Cable Clamp	50072021	2
-29	Tab—Insulated Receptacle	40062076	2
-30	Solenoid Valve Assembly—60 Hz (Models 4553/4558)	†95000~~118~~ 285	1 $83.95
	Solenoid Valve Assembly—50 Hz (Models 4554/4559)	95000114	1
	Valve—Solenoid	50630010	1
	Coil—Solenoid (60 Hz)	†40542006	1
	Coil—Solenoid (50 Hz)	40542007	1
	Bushing—Capillary	50041016	2
	Cable Clip—Solenoid Holding	50071006	1
	Screw (6-32 x 3/8)	—	—
	Nut (No. 6)	—	—
-31	Accumulator	50000005	1
-32	Filter—Drier	50150005	1
-33	Tubing	50571081	1
-34	Lead Tie	50558005	AR
-35	Connector—Tube Fitting	50155043	1
-36	Connector—Tube Fitting	50155026	1
-37	Screw (5/16 x 18) Mach. Hex	50046009	3
	Flat Washer (3/8 I.D.)	50661017	3
	Nut—Weld	50391020	3
-38	Compressor (Copeland)	40071003	1
	Compressor Parts		
-39	Capacitor—Start (115 VAC/60 Hz)	81455306	1
-40a	Relay—Current Start	81455304	1
-40b	Protector—Thermal Overload	81455303	1
-41	Housing—Evaporator	81455305	1
-42	Motor—Fan	81455307	1
-43	Fan Blade—Motor	81455308	1
	Bracket—Motor Support (Model 4559 Only)	50032336	1
	Screw (8-36 x 1/2) Pan Hd.	50550110	4
	Washer—Flat	50661070	4
	Transformer Assembly Model 4554 (220 VAC 50 Hz)	99400100	1
	Transformer Assembly Model 4558 (220 VAC 60 Hz)	99400098	1
	Screw (8-32 x 1/2) Pan Hd.	51080800	4
	Lockwasher (No. 8)	50333014	4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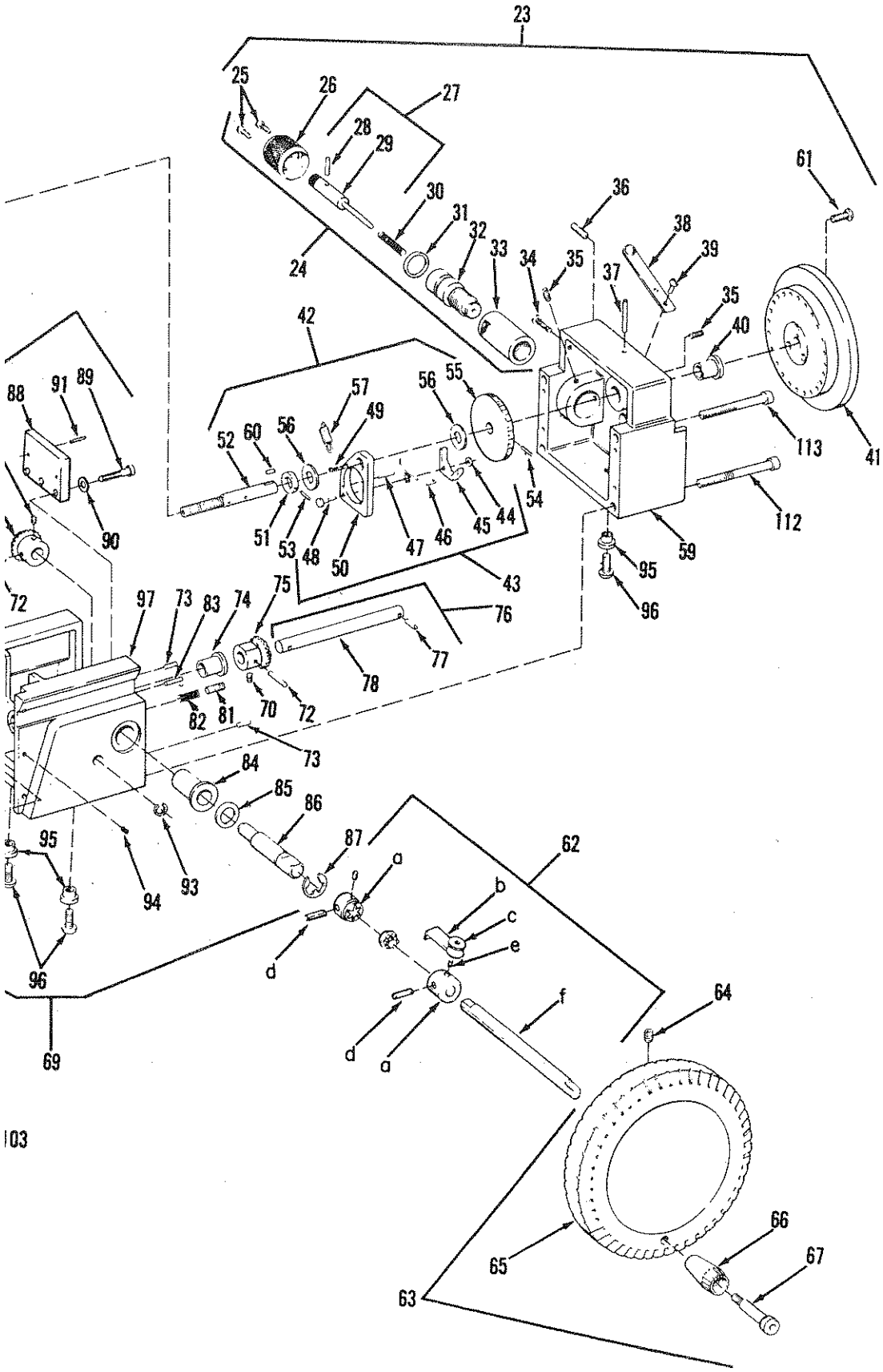


Figure 5-4
MICROTOME ASSEMBLY — EXPLODED VIEW

FIGURE & INDEX NO.	DESCRIPTION	PART NO.	NO. REQ'D.
5-4-1	Upper Slide Assembly (Top)	—	1
-2	Blade Holder Clamp Assembly	95000280	2
-3	Blade Holder Assembly	95000277	1
-4	Elevating & Locking Knob	50301007	4
-5	Blade Holder	50063032	1
-6	Blade Bumper	50034005	2
	Cement	50001013	—
-7	Screw (10-32 x 5/8) Socket Hd.	52101000	2
-8	Gib—Horizontal (Right)	50180005	1
-9	Gib—Horizontal (Left)	50180006	1
-10	Screw (8-32 x 1/4)	50550025	4
-11	Cover Plate (Left)	50455049	1
-12	Cover Plate (Right)	50455050	1
-13	Screw—Gib Spring	50550012	6
-14	Plug—Gib Spring Insert	†50457005	6
-15	Gib Spring	†50546034	6
-16	Screw (2-56 x 3/16) Rd. Hd.	51020300	4
-17	Upper Slide	50063024	1
-18	Buffer Spring	50456035	2
-19	Buffer Pin	50451053	2
-20	Pin—Spiral	50452042	2
-21	Nut—Lead Screw	50391048	1
-22	Retaining Clip—Nut	50071013	2
-23	Back Housing Assembly	99500244	1
-24	Increment Adjustment Assembly	95000285	1
-25	Screw (4-40 x 3/8) Socket Hd.	52040600	2
-26	Increment Knob	50301020	1
-27	Increment Disengaging Rod Assembly	95000284	1
-28	Pin—Dowel	50452047	1
-29	Disengaging Rod	50552015	1
-30	Compression Spring	50546031	1
-31	"O" Ring	†50421016	1
-32	Increment Screw	50550029	1
-33	Sleeve—Increment	50540022	1
-34	Screw—Ratchet Spring	50550036	1
-35	Set Screw (8-32 x 1/4)	53080401	1
-36	Set Screw (10-32 x 1/2)	53100801	1
-37	Tube—Oil	50571056	1
-38	Drag Spring Assembly	95000287	1
-39	Screw (4-40 x 1/4)	51040400	2
-40	Bearing	50044015	1
-41	Feed Wheel—Gross Adjusting	50660042	1
-42	Ratchet Wheel & Pawl Arm Assembly	81455101	1
-43	Pawl Arm Assembly	95000286	1
-44	Washer	*	1
-45	Pawl	*	1
-46	Spring Pawl	*	1
-47	Spiral Pin	50452043	1
-48	Ratchet Pin	*	1
-49	Screw (2-56 x 3/16) Round Hd.	51020300	1
-50	Pawl Arm	*	1
-51	Lead Screw Washer	*	1
-52	Lead Screw	*	1
-53	Spiral Pin	50452042	1
-54	Dowel Pin	50452046	1
-55	Ratchet Wheel	*	1
-56	Thrust Washer	50661016	2
-57	Spring—Pawl Arm	50546033	1
-59	Back Housing	*	1
-60	Key (3/32 Sq. x 1/4" Lg.)	50300002	1
-61	Screw	52100810	1
-62	Shaft & Coupling Assembly	—	—
a	Coupling Assembly (Two Piece)	†95000279	1
b	Retainer—Coupling (Clip)	†50079005	1
c	Retaining Nut	50330005	1
d	Roll Pin (5/32 x 1)	50460101	1
e	Set Screw (1/4-20 x 3/4)	53251201	1
f	Shaft—Hand Wheel	50552010	1

FIGURE & INDEX NO.	DESCRIPTION
-63	Hand Wheel Assembly
-64	Set Screw (1/4-20 x 1¼) Socket
-65	Hand Wheel
-66	Knob—Hand Wheel
-67	Bolt—Stripper (1/4-20 x 1¼ Lg.)
-68	Shield—Gear
-69	Lower Slide & Gear Housing Assemb
-70	Set Screw (3-32 x 3/16)
-71	Mitre Gear (LH)
-72	Dowel Pin (3/32 x 3/4)
-73	Dowel Pin (1/8 x 1/2)
-74	Flange Bearing
-75	Mitre Gear (RH)
-76	Crank Shaft & Actuator Pin Assem
-77	Pin—Actuator
-78	Crank Shaft
-79	Lock Shaft Assembly (Chuck Locki
-81	Lock Detent Pin—Hand Wheel
-82	Compression Spring
-83	Dowel Pin
-84	Flange Bearing
-85	Thrush Washer
-86	Shaft—Hand Wheel
-87	Retaining Ring ("C")
-88	Bearing Block—Rear (Mod.)
-89	Screw (6-32 x 3/8) Socket Hd.
-90	Lockwasher (No. 6)
-91	Roll Pin (.062 x .375)
-93	Retaining Ring
-94	Set Screw (8-32 x 1/8)
-95	Locking Pin (Bushing)
-96	Screw (10'24 x 1/2) Button Hd.
-97	Lower Slide & Gear Housing Assem
-98	Crank Arm & Pin Assembly
-99	Roll Pin—Crank (3/32 x 5/8)
-100	Crank Roller
-101	Vertical Gib
-102	Screw (8-32 x 5/8) Socket Hd.
-103	Chuck Assembly
-104	Knob Assembly—Chuck
-105	Chuck Riser
-106	Chuck
-107	Spring—Chuck
-108	Chuck Jaw
-109	Screw (5-40 x 2) Rd. Hd.
-110	Spring—Pin
-111	Pin
-112	Screw (1/4-20 x 2¼) Socket Hd.
-113	Screw (1/4-20 x 2) Socket Hd.
-115	Anti-Roll Assembly—Plate Type
-116	Screw (6-32 x 3) Pan Hd.
-117	Nut—Hex (6-32)
-118	Knob (Plastic)
	Locktite
-119	Plate (Plasic)
-120	Screw (2-56 x 3/16) Flat Hd.
-121	Nut—Hex (2-56)
-122	Tape—Scotch Magic Mending (3/16 x
-123	Screw (6-32 x 3/8) Truss Hd.
-124	Anti-Roll Assembly—Bail Type
-125	Bail (Chrome Plated)
-126	Screw (2-56 x 3/16) Rd. Hd.

ASSEMBLY—EXPLODED VIEW
(MODEL 4551)

	PART NO.	NO. REQ'D.
.....	95000128	2
Socket.....	53250404	1
.....	50660035	1
.....	50301014	1
1¼ Lg.)	50046003	1
.....	†50551010	1
ıg Assembly.....	—	1
.....	53080301	2
.....	50182005	1
.....	50452041	2
.....	50452044	4
.....	†50044015	2
.....	50182006	1
Pin Assembly	*	1
.....	*	1
.....	*	1
ıuck Locking)	95000290	1
Wheel	50452022	1
.....	50546031	1
.....	50460208	1
.....	†50044018	1
.....	50661048	1
.....	50572014	1
.....	50510043	1
d.).....	50043055	1
Hd.....	52060601	3
.....	50333002	3
.....	50460004	2
.....	50510045	2
.....	53080201	3
.....	50452038	2
ı Hd.....	51250807	2
ıg Assembly.....	*	1
ly	*	1
8).....	50460055	1
.....	50510046	1
.....	50180012	2
Hd.....	51081007	6
.....	95000276	1
.....	95000261	1
.....	50510041	1
.....	50060046	1
.....	50546058	2
.....	50270003	1
.....	51053200	1
.....	50546055	2
.....	50452033	2
Id.....	53253602	2
.....	52253200	2
Type	†99500259	1
.....	51063200	1
.....	50391004	1
.....	50301005	1
.....	—	—
.....	†50455038	1
l.....	51020301	2
.....	50391087	2
ing (3/16 x 3/16).....	—	—
.....	51060608	1
ype.....	†95000283	1
.....	†50030015	1
.....	51020301	1

FIGURE & INDEX NO.	DESCRIPTION	PART NO.	NO. REQ'D.
	ACCESSORIES		
	Accessory Kit Assembly	†95000291	—
-127	Knife—Microtome	50300001	—
	Handle—Knife	50211002	—
	Lubricant (A) Oil	†95000300	—
	Lubricant (B) Oil	†95000281	—
	Lubricant (G) Grease	†95000282	—
	Hex Key (1/8)	50300004	—
	Hex Key (9/64)	50300005	—
	Hex Key (5/32)	50300007	—
	Hex Key (5/64)	50300009	—
	Hex Key (3/32)	50300010	—
	Hex Key (3/16)	50300011	—
	PRODUCT CODE ITEMS		
-128	Tissue-Tek II Object Holder (without holes)	4560	—
-128	Tissue-Tek II Object Holder (with holes)	4561	—
	Microtome Lubrication Kit	4556	—
	Tissue-Tek II Standard Cryomold®	4557	—
	Tissue-Tek II Biopsy Cryomold®	4565	—
	Tissue-Tek II Intermediate Cryomold®	4566	—
	Tissue-Tek II Biopsy Adapter	4567	—
	Tissue-Tek II Intermediate Adapter	4568	—
	Tissue-Tek II CO_2 Quick-Freeze Attachment	4570	—
	Tissue-Tek II OCT Compound, 4 oz. bottle	4583	—
	SHIPPING ITEMS		
	Shipper—Microtome	50453159	—

Items denoted * are not available for field replacement!

SECTION 6 CRYOSTAT WIRING DIAGRAMS

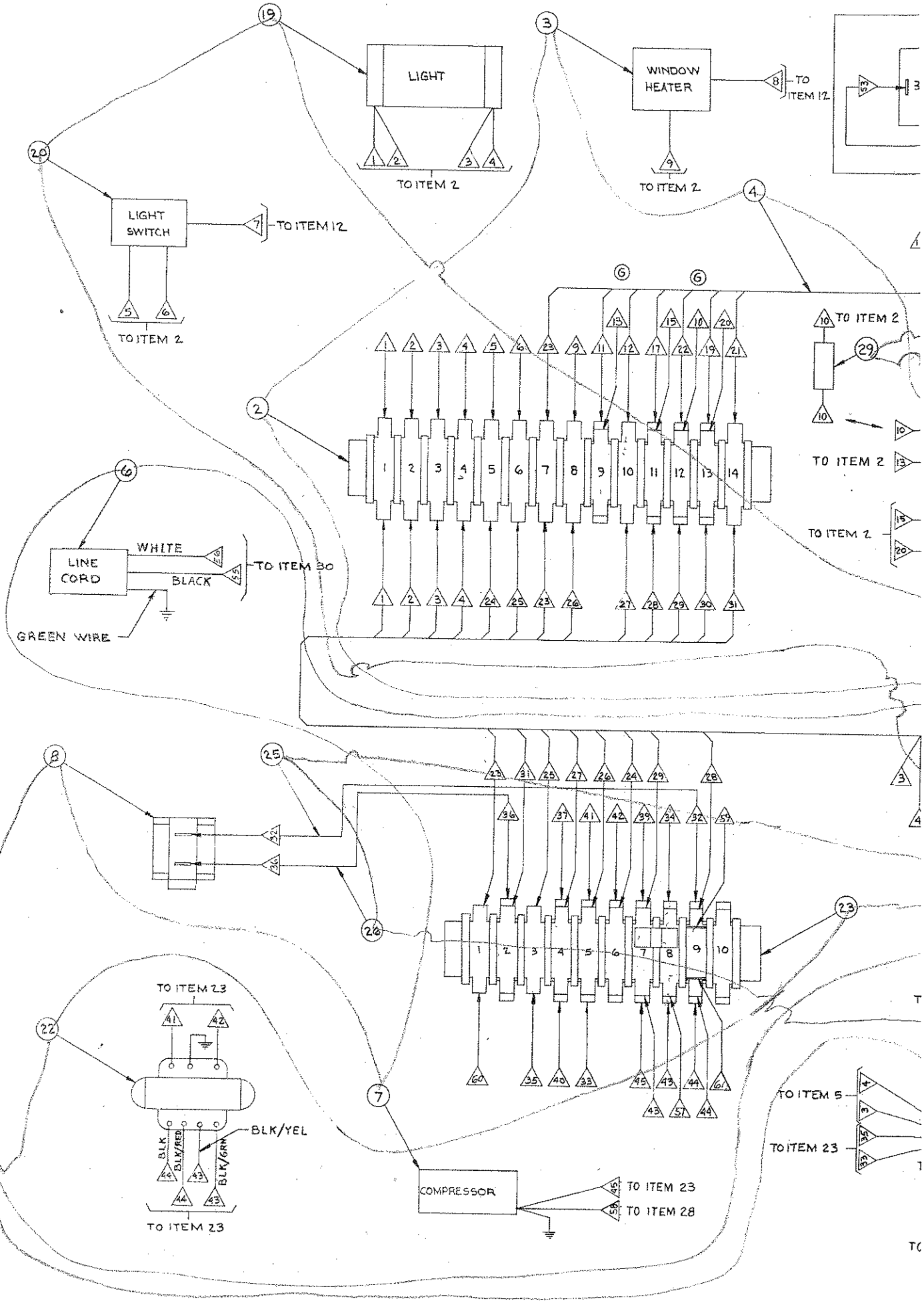
INDEX

FIGURE			PAGE
6-1	Model 4553	120 V 60 Hz	6.3
6-2	Model 4554	220 V 50 Hz	6.4
6-3	Model 4558	220 V 60 Hz	6.5

COMPONENT IDENTIFICATION
WIRING DIAGRAMS

ITEM	DESCRIPTION
1	Trim Heater
2	Terminal Strip (14)
3	Window Heater
4	Cable Harness
5	Cable Harness
6	Line Cord
7	Compressor
8	Solenoid Valve
9	Thermostat
10	Defrost Control Timer
11	Switch ON-OFF
12	Terminal Strip (6)
13	Jumper Assembly
14	Jumper Assembly
15	Jumper Assembly (4553)
15	Resistor Assembly (4554/4558)
16	Jumper Assembly
17	Defrost Heater
18	Pan Heater
19	Lamp
20	Window Switch
21	Ballast
22	Isolation Transformer
23	Terminal Strip (10)
24	Relay (R1)
25	Jumper Assembly
26	Jumper Assembly
27	Top Heater
28	Relay (R2) (4553)
28	Transformer (4554/4558)
29	OTP (4553)
29	Tab — Insl. Recept. (4554/4558)
30	Cable Assembly (4553)
30	Relay (R2) (4554/4558)
31	GFCI (4553)
31	OTP (4554/4558)

Figure 6-1
MODEL 4553 WIRING INSTALLATION DIAGRAM



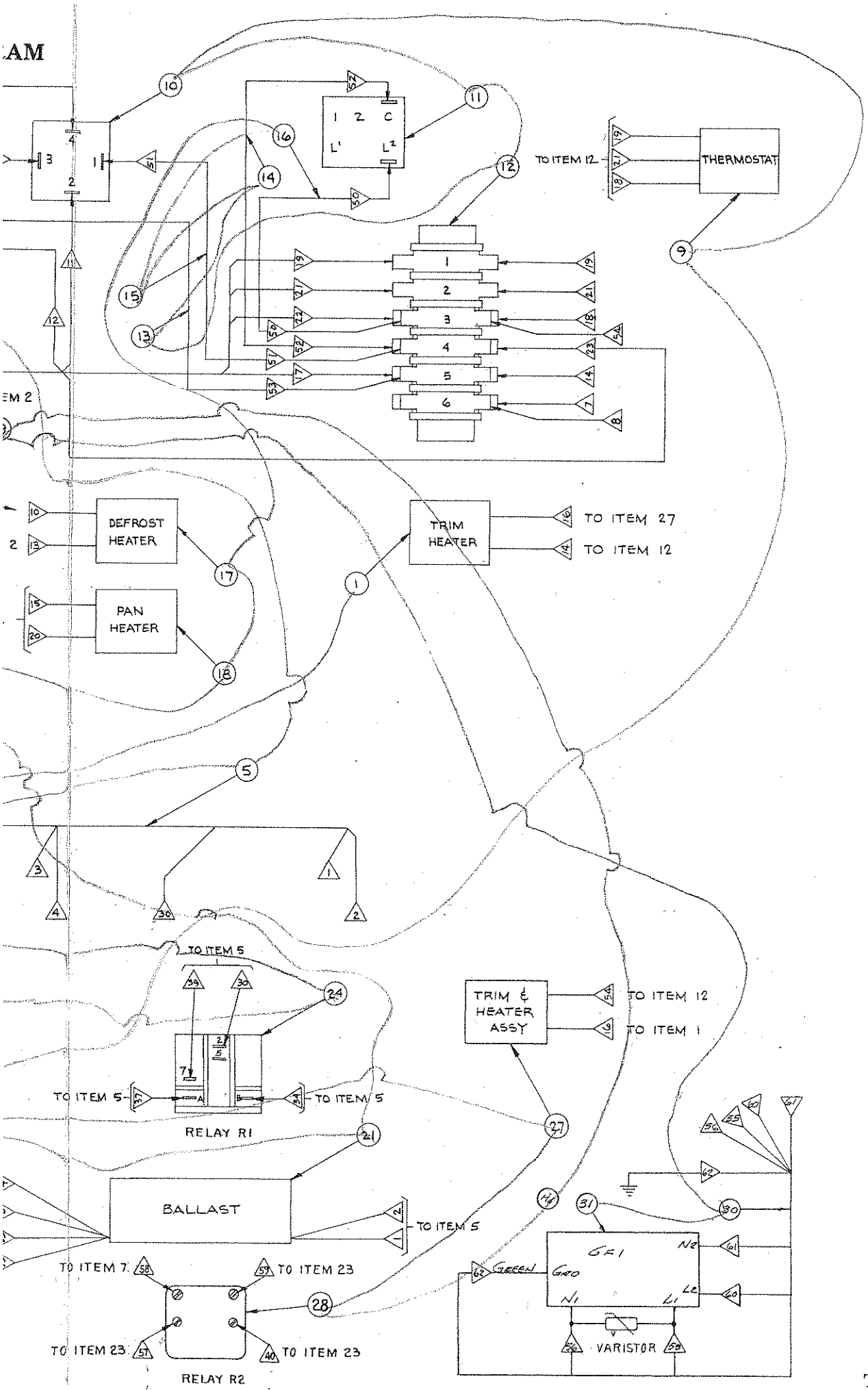
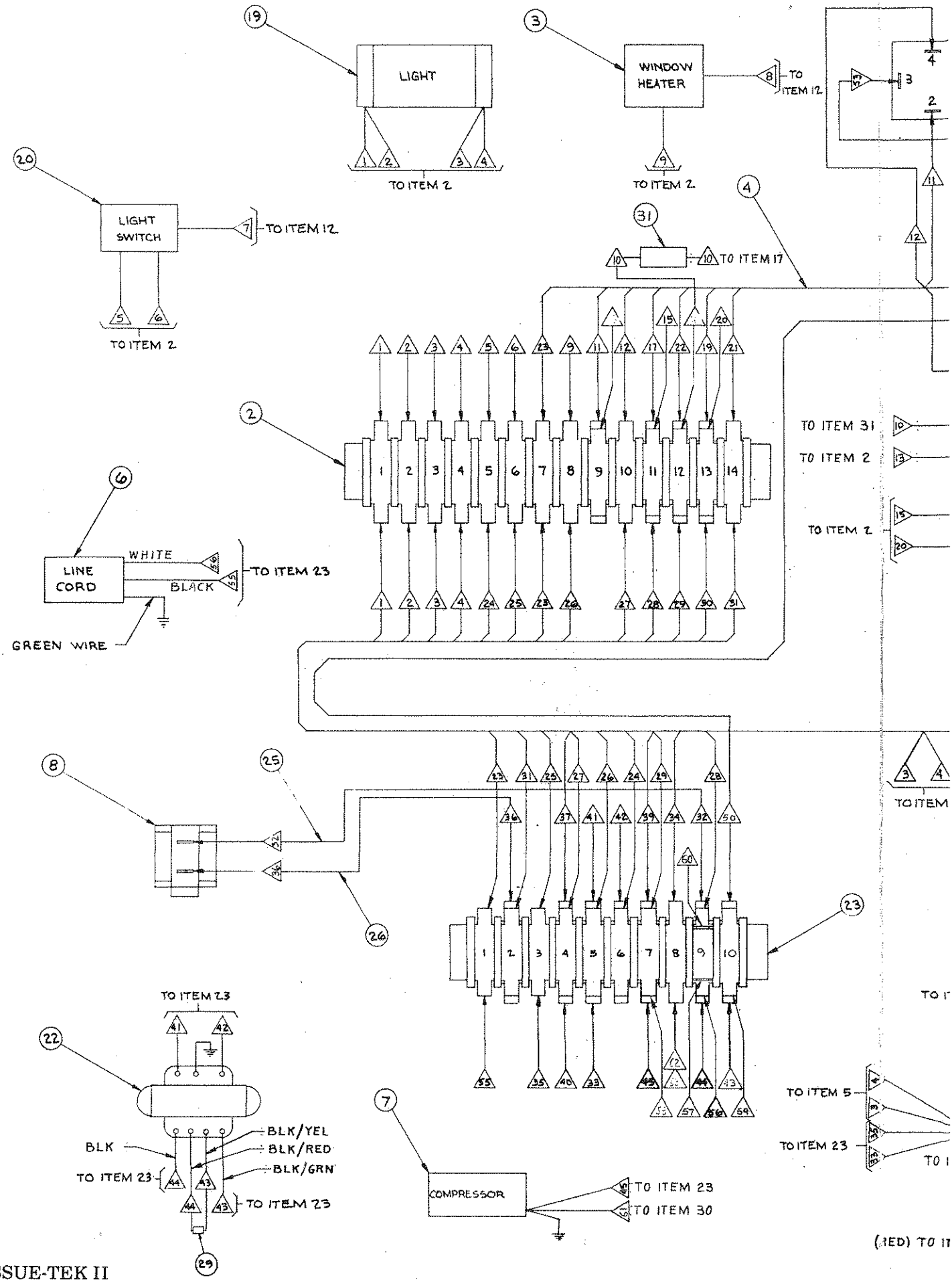
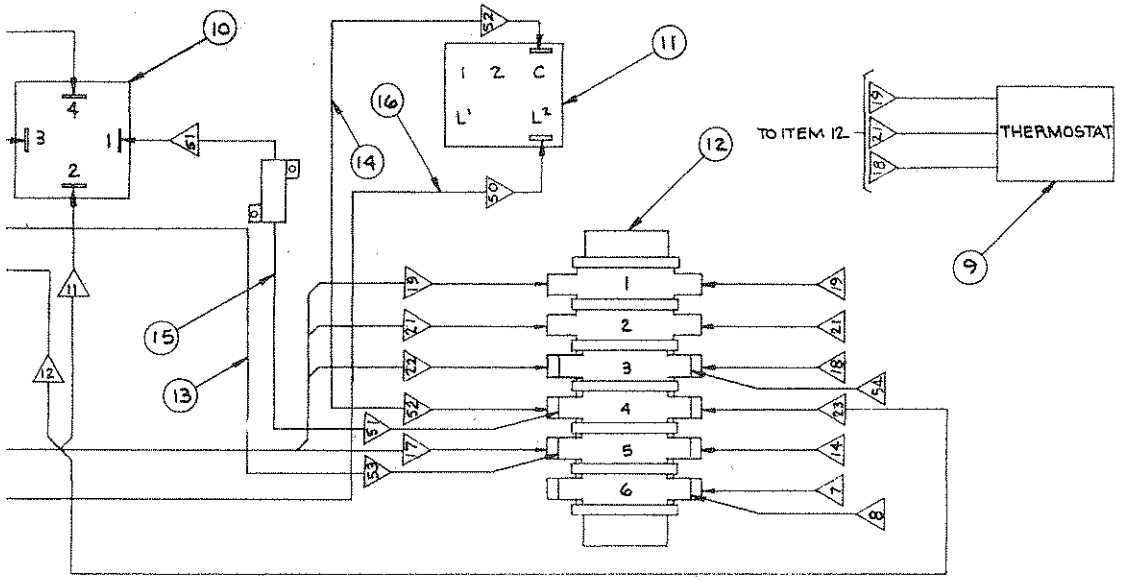
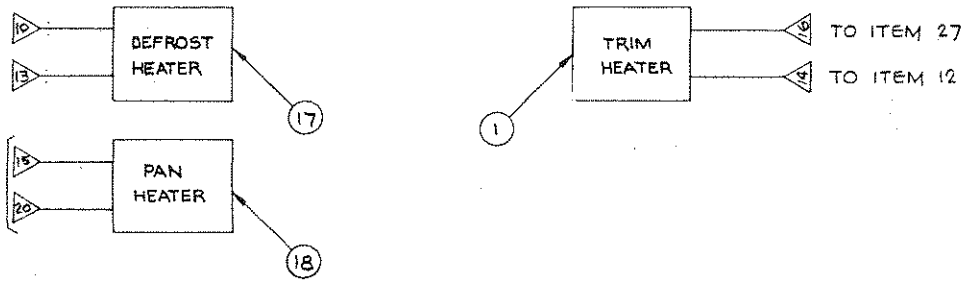

AM
TO ITEM 12
THERMOSTAT
DEFROST HEATER
TRIM HEATER
TO ITEM 27
TO ITEM 12
PAN HEATER
TO ITEM 5
TRIM & HEATER ASSY
TO ITEM 12
TO ITEM 1
TO ITEM 5
TO ITEM 5
RELAY R1
BALLAST
TO ITEM 5
TO ITEM 7
TO ITEM 23
TO ITEM 23
TO ITEM 23
RELAY R2
GFI
GREEN
VARISTOR

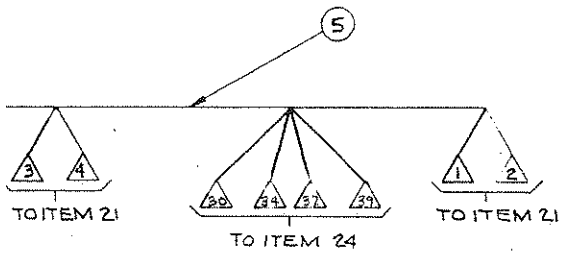
Figure 6-2
MODEL 4554 WIRING INSTALLATION DIAGRAM

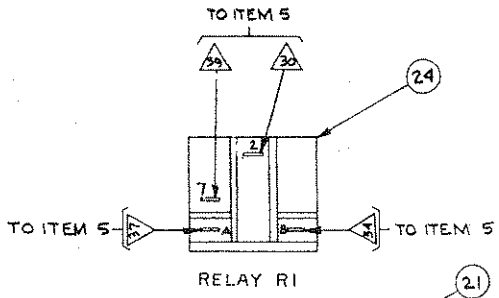


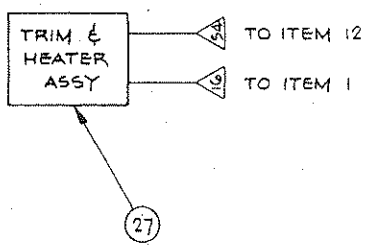
M

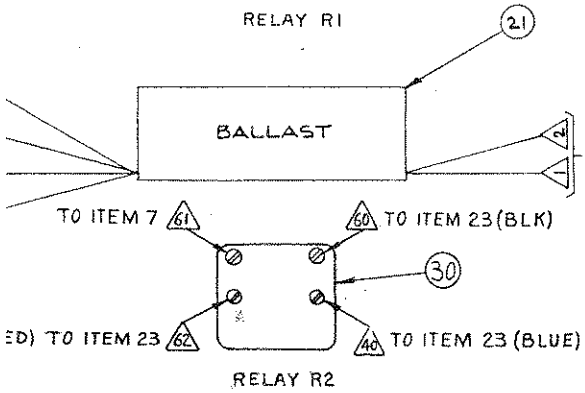

1 2 C
L1 L2
THERMOSTAT
TO ITEM 12
1
2
3
4
5
6

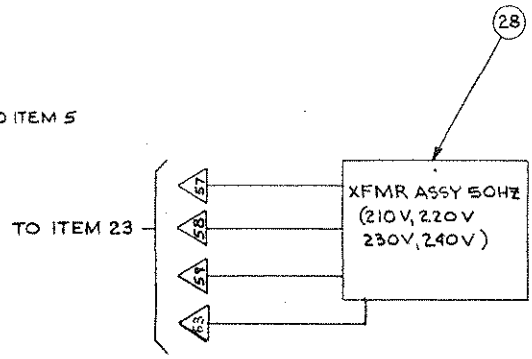

DEFROST HEATER
TRIM HEATER
TO ITEM 27
TO ITEM 12
PAN HEATER


TO ITEM 21
TO ITEM 24
TO ITEM 21


TO ITEM 5
TO ITEM 5
TO ITEM 5
RELAY R1


TRIM & HEATER ASSY
TO ITEM 12
TO ITEM 1


BALLAST
TO ITEM 5
TO ITEM 7
TO ITEM 23 (BLK)
TO ITEM 23 (BLUE)
RELAY R2


XFMR ASSY 50HZ (210V, 220V 230V, 240V)
TO ITEM 23

Temperature Conversion Table

Celsius to Fahrenheit

to C	F/C	to F	to C	F/C	to F	to C	F/C	to F	to C	F/C	to F
-184.4	-300	-508.0	204.4	400	752.0	593.3	1100	2012.0	982.2	1800	3272.0
-178.9	-290	-490.0	210.0	410	770.0	598.9	1110	2030.0	987.8	1810	3290.0
-173.3	-280	-472.0	215.6	420	788.0	604.4	1120	2048.0	993.3	1820	3308.0
-167.8	-270	-454.0	221.1	430	806.0	610.0	1130	2066.0	998.9	1830	3326.0
-162.2	-260	-436.0	226.7	440	824.0	615.6	1140	2084.0	1004.4	1840	3344.0
-156.7	-250	-418.0	232.2	450	842.0	621.1	1150	2102.0	1010.0	1850	3362.0
-151.1	-240	-400.0	237.8	460	860.0	626.7	1160	2120.0	1015.6	1860	3380.0
-145.6	-230	-382.0	243.3	470	878.0	632.2	1170	2138.0	1021.1	1870	3398.0
-140.0	-220	-364.0	248.9	480	896.0	637.8	1180	2156.0	1026.7	1880	3416.0
-134.4	-210	-346.0	254.4	490	914.0	643.3	1190	2174.0	1032.2	1890	3434.0
-128.9	-200	-328.0	260.0	500	932.0	648.9	1200	2192.0	1037.8	1900	3452.0
-123.3	-190	-310.0	265.6	510	950.0	654.4	1210	2210.0	1043.3	1910	3470.0
-117.8	-180	-292.0	271.1	520	968.0	660.0	1220	2228.0	1048.9	1920	3488.0
-112.2	-170	-274.0	276.7	530	986.0	665.6	1230	2246.0	1054.4	1930	3506.0
-106.7	-160	-256.0	282.2	540	1004.0	671.1	1240	2264.0	1060.0	1940	3524.0
-101.1	-150	-238.0	287.8	550	1022.0	676.7	1250	2282.0	1065.6	1950	3542.0
-95.6	-140	-220.0	293.3	560	1040.0	682.2	1260	2300.0	1071.1	1960	3560.0
-90.0	-130	-202.0	298.9	570	1058.0	687.8	1270	2318.0	1076.7	1970	3578.0
-84.4	-120	-184.0	304.4	580	1076.0	693.3	1280	2336.0	1082.2	1980	3596.0
-78.9	-110	-166.0	310.0	590	1094.0	698.9	1290	2354.0	1087.8	1990	3614.0
-73.3	-100	-148.0	315.6	600	1112.0	704.4	1300	2372.0	1093.3	2000	3632.0
-67.8	-90	-130.0	321.1	610	1130.0	710.0	1310	2390.0	1098.9	2010	3650.0
-62.2	-80	-112.0	326.7	620	1148.0	715.6	1320	2408.0	1104.4	2020	3668.0
-56.7	-70	-94.0	332.2	630	1166.0	721.1	1330	2426.0	1110.0	2030	3686.0
-51.1	-60	-76.0	337.8	640	1184.0	726.7	1340	2444.0	1115.6	2040	3704.0
-45.6	-50	-58.0	343.3	650	1202.0	732.2	1350	2462.0	1121.1	2050	3722.0
-40.0	-40	-40.0	348.9	660	1220.0	737.8	1360	2480.0	1126.7	2060	3740.0
-34.4	-30	-22.0	354.4	670	1238.0	743.3	1370	2498.0	1132.2	2070	3758.0
-28.9	-20	-4.0	360.0	680	1256.0	748.9	1380	2516.0	1137.8	2080	3776.0
-23.3	-10	14.0	365.6	690	1274.0	754.4	1390	2534.0	1143.3	2090	3794.0
-17.8	0	32.0	371.1	700	1292.0	760.0	1400	2552.0	1148.9	2100	3812.0
-12.2	10	50.0	376.7	710	1310.0	765.6	1410	2570.0	1154.4	2110	3830.0
-6.7	20	68.0	382.2	720	1328.0	771.1	1420	2588.0	1160.0	2120	3848.0
-1.1	30	86.0	387.8	730	1346.0	776.7	1430	2606.0	1165.6	2130	3866.0
4.4	40	104.0	393.3	740	1364.0	782.2	1440	2624.0	1171.1	2140	3884.0
10.0	50	122.0	398.9	750	1382.0	787.8	1450	2642.0	1176.7	2150	3902.0
15.6	60	140.0	404.4	760	1400.0	793.3	1460	2660.0	1182.2	2160	3920.0
21.1	70	158.0	410.0	770	1418.0	798.9	1470	2678.0	1187.8	2170	3938.0
26.7	80	176.0	415.6	780	1436.0	804.4	1480	2696.0	1193.3	2180	3956.0
32.2	90	194.0	421.1	790	1454.0	810.0	1490	2714.0	1198.9	2190	3974.0
37.8	100	212.0	426.7	800	1472.0	815.6	1500	2732.0	1204.4	2200	3992.0
43.3	110	230.0	432.2	810	1490.0	821.1	1510	2750.0	1210.0	2210	4010.0
48.9	120	248.0	437.8	820	1508.0	826.7	1520	2768.0	1215.6	2220	4028.0
54.4	130	266.0	443.3	830	1526.0	832.2	1530	2786.0	1221.1	2230	4046.0
60.0	140	284.0	448.9	840	1544.0	837.8	1540	2804.0	1226.7	2240	4064.0
65.6	150	302.0	454.4	850	1562.0	843.3	1550	2822.0	1232.2	2250	4082.0
71.1	160	320.0	460.0	860	1580.0	848.9	1560	2840.0	1237.8	2260	4100.0
76.7	170	338.0	465.6	870	1598.0	854.4	1570	2858.0	1243.3	2270	4118.0
82.2	180	356.0	471.1	880	1616.0	860.0	1580	2876.0	1248.9	2280	4136.0
87.8	190	374.0	476.7	890	1634.0	865.6	1590	2894.0	1254.4	2290	4154.0
93.3	200	392.0	482.2	900	1652.0	871.1	1600	2912.0	1260.0	2300	4172.0
98.9	210	410.0	487.8	910	1670.0	876.7	1610	2930.0	1265.6	2310	4190.0
104.4	220	428.0	493.3	920	1688.0	882.2	1620	2948.0	1271.1	2320	4208.0
110.0	230	446.0	498.9	930	1706.0	887.8	1630	2966.0	1276.7	2330	4226.0
115.6	240	464.0	504.4	940	1724.0	893.3	1640	2984.0	1282.2	2340	4244.0
121.1	250	482.0	510.0	950	1742.0	898.9	1650	3002.0	1287.8	2350	4262.0
126.7	260	500.0	515.6	960	1760.0	904.4	1660	3020.0	1293.3	2360	4280.0
132.2	270	518.0	521.1	970	1778.0	910.0	1670	3038.0	1298.9	2370	4298.0
137.8	280	536.0	526.7	980	1796.0	915.6	1680	3056.0	1304.4	2380	4316.0
143.3	290	554.0	532.2	990	1814.0	921.1	1690	3074.0	1310.0	2390	4334.0
148.9	300	572.0	537.8	1000	1832.0	926.7	1700	3092.0	1315.6	2400	4352.0
154.4	310	590.0	543.3	1010	1850.0	932.2	1710	3110.0	1321.1	2410	4370.0
160.0	320	608.0	548.9	1020	1868.0	937.8	1720	3128.0	1326.7	2420	4388.0
165.6	330	626.0	554.4	1030	1886.0	943.3	1730	3146.0	1332.2	2430	4406.0
171.1	340	644.0	560.0	1040	1904.0	948.9	1740	3164.0	1337.8	2440	4424.0
176.7	350	662.0	565.6	1050	1922.0	954.4	1750	3182.0	1343.3	2450	4442.0
182.2	360	680.0	571.1	1060	1940.0	960.0	1760	3200.0	1348.9	2460	4460.0
187.8	370	698.0	576.7	1070	1958.0	965.6	1770	3218.0	1354.5	2470	4478.0
193.3	380	716.0	582.2	1080	1976.0	971.1	1780	3236.0	1360.0	2480	4496.0
198.9	390	734.0	587.8	1090	1994.0	976.7	1790	3254.0	1365.6	2490	4515.0

Tissue-Tek® Accu-Edge®

UNIVERSAL CRYOSTAT BLADE SYSTEM

INTRODUCTION

The Tissue-Tek® Accu-Edge® Universal Cryostat Blade System is designed to fit most Lipshaw, IEC, and Hacker-Bright model cryostats, as well as other common conventional cryostats. The disposable blade system provides the user with a convenient method of preparing quality sections from frozen specimens for microscopic examination.

CONTENTS

Included with the Accu-Edge Universal Cryostat Blade System (Product No. 4681) are the following components:

- Storage Box
- Blade Holder, Blade Fixing Plate, and Antiroll Device (see Figure 1)
- Replacement Screws (2)
- Replacement Antiroll Plate
- Screwdriver
- Allen Wrench
- Disposable Blades (50) in Dispenser Box

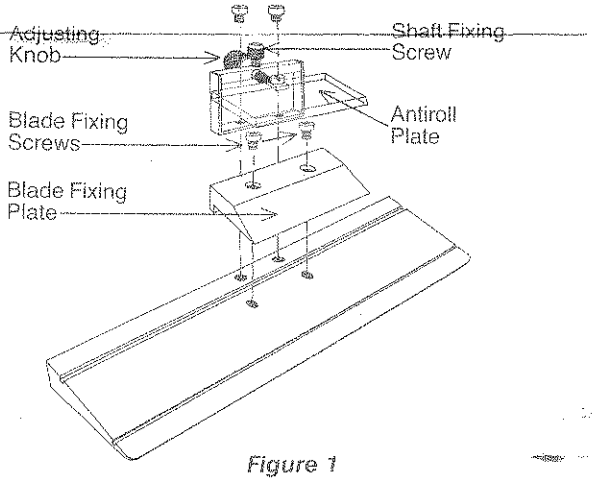


Figure 1

UNPACKING

1. Remove the blade holder from the storage box. Discard the anticorrosive paper that protects the blade holder.
2. The blade holder is coated with an anticorrosive oil. Completely remove this coating using gauze dampened with xylene.

INSTALLATION

The Accu-Edge Universal Cryostat Blade System is equipped with a specially designed antiroll device. Prior to mounting the blade holder, attach small strips of cellophane adhesive tape at the edges of the underside surface of the antiroll plate (Figure 2). The tape will provide the appropriate clearance between the antiroll plate and the blade fixing plate.

Mount the blade holder in the same manner as for conventional microtome knives, following the directions given in your microtome/cryostat operating manual.

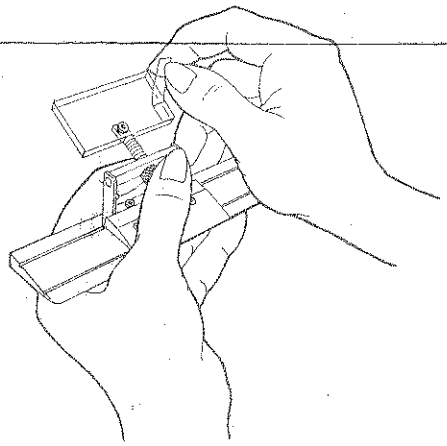


Figure 2

INSERTION OF DISPOSABLE BLADE

1. Loosen the two screws of the blade fixing plate, using the screwdriver provided.
2. Carefully remove the used blade and place it in the used blade compartment on the underside of the dispenser box.

3. Move the blade ejector slide knob (on the top of the blade dispenser box) to the far right position. Then move the slide knob to the far left position to dispense a blade (Figure 3).

   WARNING: Disposable blades are extremely sharp and can cause serious injury. Use care when handling blades.

4. Carefully center the disposable blade beneath the blade fixing plate, then tighten the blade fixing screws.
5. Allow the blade holder and disposable blade to reach the temperature of the cryostat chamber before using.

   NOTE: The disposable blade dispenser box may be stored within the cryostat chamber.

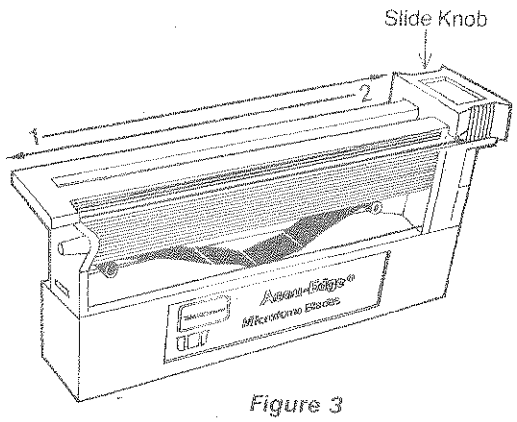


Figure 3

SETTING THE ANTIROLL PLATE

1. If the antiroll plate does not lay parallel to the blade edge, loosen the two screws that attach the antiroll device to the blade holder (using the Allen wrench supplied). Align the device, then carefully tighten the screws.
2. Adjust the position of the antiroll plate by advancing or retracting the plate, as described below:
   a. Loosen the shaft fixing screw by turning it counterclockwise.
   b. Turn the adjusting knob counterclockwise to advance the antiroll plate forward; turn the knob clockwise to retract it.
   c. After the antiroll plate is positioned properly, tighten the shaft fixing screw by turning it clockwise.

MAINTENANCE AND STORAGE

1. Daily Maintenance:
   a. Loosen the two blade fixing screws and carefully remove the disposable blade. Place the used blade into the used blade compartment in the dispenser box.
   b. Remove the blade holder from the microtome.
   c. Remove the two blade fixing screws, then remove the blade fixing plate from the blade holder.
   d. Soak the blade holder and blade fixing plate in 70% alcohol to remove any residual O.C.T. Compound and/or tissue. Remove from the 70% alcohol and dip in 100% alcohol to remove moisture.
   e. Using gauze moistened with machine oil, wipe all surfaces of the blade holder. Do not oil the Teflon-coated blade fixing plate.
   f. Reassemble the blade fixing plate onto the blade holder. Replace and tighten the blade fixing screws.
2. The blade holder should always be reinstalled in the cryostat or stored carefully in the storage box.

NOTES AND PRECAUTIONS

1. Use care when handling the blade holder body. Rough handling may cause misalignment or damage to the finish.
2. Never handle the blade holder body with a disposable blade in place.
3. If the blade holder will not be used for an extended period, disassemble the blade holder and blade fixing plate. Fully coat the blade holder with oil (do not coat the Teflon-coated blade fixing plate) before placing in the storage box.
4. Disposable blades are coated with silicon oil, which does not need to be removed before use.
5. Used blades are dangerous. Place them in the used blade compartment in the disposable blade dispenser box. When all blades have been used, discard the dispenser box safely and without opening.

ACCESSORIES

4689 Tissue-Tek® Accu-Edge® Blades Dispenser (50 blades/dispenser; 10 dispensers/case)

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